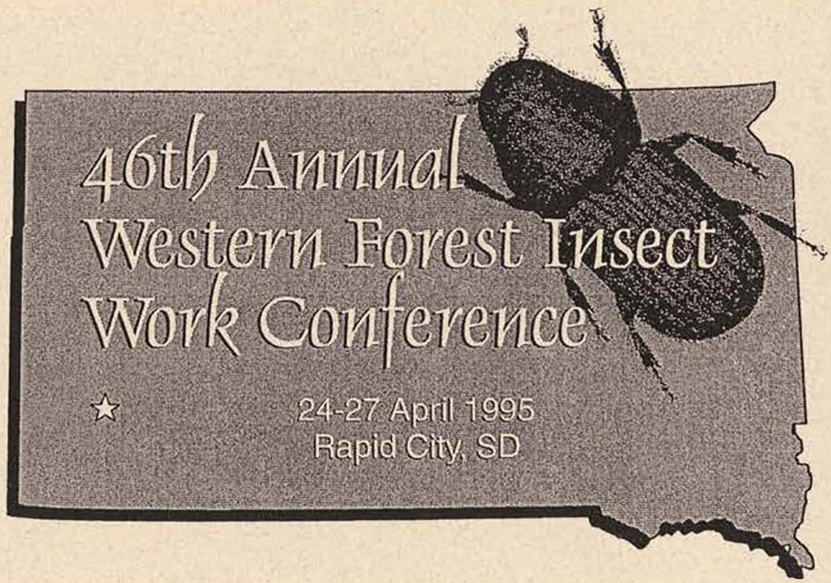
WFIWC 1995

Proceedings
of the
46th Annual Meeting
of the
Western Forest Insect Work Conference

Rapid City, South Dakota
April 24-27, 1995



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*** Not for Citation ***
Information for Conference Members

Articles were formatted for consistency, but otherwise printed as submitted. Authors are responsible for content.

WESTERN FOREST INSECT WORK CONFERENCE
46th ANNUAL MEETING
Alex Johnson Hotel
Rapid City, SD

Executive Committee

Don Dahlsten, Chair
Carroll Williams, Secretary
Ladd Livingston, Treasurer
Jan Volney, Counselor
Nancy Rappaport, Counselor
Jorge Macias-Samorano, Counselor

1995 Organizing Committee

Program Committee
Ann Lynch, Chair
John Schmid
Tom Eager
José Negrón

Registration
Rich Dorsett
Rapid City Chamber of Commerce

Photographs
Tom Juntti
Bill Schaupp

Local Arrangements
Bill Schaupp, Chair
Tom Juntti
Ken Lister

Fun Run
Bruce Hostetler
Darrell Ross

Field Trip
John Schmid
Steve Mata
Bill Olsen
John Lundquist
Dave Johnson

Foreword

A number of circumstances prevented timely completion of these proceedings soon after the meeting was held in April, 1995. The membership of the Conference approved a resolution during the Final Business Meeting of the 2002 Annual Meeting held in Whitefish, Montana. In brief, the purpose of the resolution was to obtain the documentation needed and to publish the proceedings.

With the help of many individuals, a preliminary version of the proceedings was prepared in December of 2002, posted in the conference website, and updated in January and February of 2003. In late March 2003, a major portion of the original documentation of the conference was recovered and used to complete the proceedings.

The Conference Chair would like to thank the following individuals who have been instrumental in contributing to the completion of these proceedings: Ladd Livingston, Ann Lynch, Malcolm Furniss, and Bill Schaupp. Other individuals have also helped by typing or reformatting documents, including Angie Harris, Barbara Bentz, Steve Mata, and Amber Kroll. Malcolm Furniss provided a number of photos. Thanks are also expressed to the following: authors and moderators who submitted relocated summaries and also to those who attempted to relocate or recover summaries but were not able to submit them; to Katharine Sheehan for posting earlier versions of these proceedings on the conference website; and to Joyce VanDeWater for scanning some of the photos and putting together the conference photo collages.

José Negrón
Conference Chair
Fort Collins, CO
April 2003

Table of Contents

Conference Program

Monday, 24 April

3:00 – 5:00 Executive Committee - Rushmore Room

5:00 – 7:00 Registration

6:00 – 8:00 Mixer

Tuesday, 25 April

7:30 – 8:30 Registration

8:00 – 9:15 Business Meeting – Yesterday's Ballroom

9:15 – 9:30 Welcome to the Black Hills National Forest

9:30 – 10:00 *Custer's 1874 Expedition to the Black Hills: Then and Now.*
Cameron Ferweda, retired, US Forest Service

10:00 – 10:15 Gene Amman's Founders Award Speech

10:15 – 10:45 Coffee

10:45 – 12:15 Panel: *Historic and current pest management in the Black Hills.*
Moderator: Ken Lister, retired, US Forest Service, R2 Forest Pest Management – Yesterday's Ballroom.

Mining and Settlement History of the Black Hills.
Dave Miller, Black Hills State University

The Black Hills: A View of the Past.[1]
Deanna Reyher, US Forest Service, Black Hills NF

One hundred years of mountain pine beetles in the Black Hills.
Bill McCambridge, retired, US Forest Service, Rocky Mountain Station

Forest Planning and Pest Management in the Black Hills.
Judy Pasek, US Forest Service, R2 Forest Health Management

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[1] Information presented was subsequently published in: Parrish, J. Barry; Herman, Daryl J.; Reyher, Deanna J. 1996. A Century of Change in Black Hills Forest and Riparian Ecosystems. B 722. U.S. Forest Service, Agricultural Experiment Station, U.S. Department of Agriculture, South Dakota State University.

12:15 – 1:45 Lunch at the Hotel Alex Johnson
Ron Stark's Founders Award Speech

1:45 – 3:15 Concurrent Workshops: Session 1:

A. Stand conditions associated with mountain pine beetle. Bill Olsen
B. Landscape disturbance measures and indices: planning applications. John Lundquist
C. Successful applications of forest pest research. Peter Hall
D. Current Issues in State and Private Forestry. Rich Dorset

3:15 – 3:45 Concurrent Workshops: Session 2:

A. Mountain Pine Beetle Silviculture and Management for Now and the Future. Steve Munson
B. Pest Models and Decision Support Systems. Terry Shore
C. East-side Ecosystem Management Project: Assessment of the Terrestrial Invertebrate Fauna. Chris Niwa and Roger Sandquist
D. Insects in the Urban/Forest Interface. Dave Leatherman

5:00 - ? *Pine Bark Beetle Model.* Eric Smith & Lance David

5:15 Fun run

Wednesday, 26 April

8:00 – 9:30 Concurrent Workshops: Session 3:

A. Systematics, taxonomy, and collections. Tom Eager
B. Role of Insects and Diseases in Subalpine fir decline. Ladd Livingston
C. Gypsy Moth. Noel Schneeberger
D. Regeneration and Reproduction Insects. Wayne Berisford
E. Impromptu Group

9:30 – 10:30 Poster Session with coffee, pastries, and group photos.

10:30 – 12:00 Panel: *History Committee: Objectives, Progress, Use, and Responsibilities*. Moderator: Ann Lynch, US Forest Service, Rocky Mountain Station – Yesterday's Ballroom.

Depredations in the Black Hills Forest Preserve, 1897 – 1912: Hopkins Begins our Legacy.
Malcolm Furniss, retired, US Forest Service, Intermountain Station.

Using Historical Records in Ecosystem Management.

Sandra Kegley, US Forest Service, Region 1, Coop. Forestry & Pest Mgmt.

The History of Forest Entomology in the Western Universities.
Don Dahlsten, University of California.

History Committee: Objectives, Progress, and What Do You Want from US?
Boyd Wickman, retired, US Forest Service, Pacific Northwest Station.

12:00 – 1:30 Lunch – on your own

1:30 – 3:00 Panel: *Forest Insect Research and Management in a Reinvented Forest Service.* Moderator: Ann Bartuska, Director, Forest Health Protection, USDA Forest Service – Yesterday's Ballroom.

Forest Health Initiative.
Ann Bartuska.

A New Look for Research.
Bob Bridges, US Forest Service, Forest Insect & Disease Research.

Making Technology Available.
Bill White, US Forest Service, Methods Applications Group.

Incorporating Disturbance Ecology into Management.
Bob Averill, US Forest Service, Region 2, Forest Health Management

Communicating about Forest Health.
Joe Lewis, US Forest Service, Forest Health Protection.

3:00 – 3:30 Coffee

3:30 – 5:00 Concurrent Workshops: Session 4:

A. Riparian Insects. Jill Wilson
B. Insect Associated with Non-Timber Resources: Planning Considerations. Iral Ragenovich
C. Non-Target Considerations for Bio control. R. Reardon and Bill Schaupp
D. Time Series Analysis of Forest Pest Data. Sandy Liebhold

5:00 – 6:30 Cash bar at the Prairie Edge.

6:30 Banquet at the Alex Johnson Hotel,
featuring The Black Hills Chorus of Sweet Adelines International

Submitted Posters, as of 17 April 1995.

Title:	Vision 20:21 – A preview of the 2nd North American Forest Insect Work Conference.
Authors:	Ron Billings and Evan Nebeker
Title:	Rules-based INFORMS.
Authors:	Patrice Janiga
Title:	Effects of an insecticide treatment on the balsam twig aphid and it's natural enemies in a Wisconsin Christmas tree plantation.
Authors:	P.K. Kleintjes and R.L. Van Nelson
Title:	Data visualization applications in forest health management.
Authors:	A.M. Lynch, B. Orland, T.C. Daniel, H.M. Maffei
Title:	Airborne videography for forest pest management.
Authors:	Dick Myhre
Title:	Insect and diseases shape our forest environment.
Authors:	Judy Pasek
Title:	The World Wide Web. – *Invited Poster*
Authors:	Dave Roschke
Title:	HUSSI – The Hopkins U.S. System Index – A data base of forest insects, their hosts, parasitoids, and predators.
Authors:	Torof R. Torgersen and Melvin E. McKnight
Title:	Herbivorous insects and global change: Potential changes in the spatial distribution of forest defoliator insects.
Authors:	David W. Williams and Andrew M. Liebhold
Title:	Responses to the WFIWC'95 Suggestion Form: Some Interesting Observations.
Authors:	Ann M. Lynch
Title:	A new bioassay to examine the effects of plant defensive compounds on wood boring insects.
Authors:	Kier D. Klepzig, Eugene B. Smalley, Kenneth F. Raffa
Title:	Biological control of the blue gum psyllid in California.
Authors:	D.L. Dahlsten, D.L. Rowney, R.L. Tassan, W.A. Copper, W.E. Chaney, K.L. Robb, M. Biarichi, P.Lane

Title:	Effects of stand thinning and beetle quality on southern pine beetle (*Dendroctonus frontalis*) success.
Authors:	R.T. Wilkens, M.Ayres, P.L. Lorio Jr., E.G. Vallery
Title:	Landscape scale predictions of bark beetle phenology.
Authors:	B.J. Bentz, J.A. Logan, P.V. Bolstad
Title:	Population diagnosis and forecasting with PAS.
Authors:	A.A. Beryman
Title:	The European pine shoot beetle: A potential new pest of Southern pine forests.
Authors:	T.J. Eager, C.W. Berisford, M.J. Dalusky
Title:	WFIWC History.
Authors:	Malcolm Furniss et al.
Title:	Management of mountain pine beetle.
Authors:	Donald Tinsley

Thursday, 27 April

8:00 – 9:30 Final Business Meeting

9:45 – 5:30 Field Trip
John Schmid, Steve Mata, John Lundquist, and Bill Schaupp

Bus loads at 9:45. *Be there or be left!*

We will visit an area of the recent mountain pine beetle (MPB) epidemic in ponderosa pine in the Black Hills, walking through plots with varying levels of partial cuts, and observing the relationship between MPB-caused mortality and growing stock level. MPB infestation patterns will be discussed in relation to stand characteristics and primary focus trees. Pest microclimate studies will be reviewed while equipment is demonstrated. Incidence and distribution of *Armillaria* root disease and it's possible relationship with MPB will be described; as time permits, management decisions and public response will be described.

Lunch is provided. Depending interest and time constraints, a visit may be made to the Shrine of Democracy at Mount Rushmore.

WESTERN FOREST INSECT WORK CONFERENCE
46TH ANNUAL MEETING
RAPID CITY, SOUTH DAKOTA

Minutes of the Executive Committee Meeting
April 24, 1995

Chair Donald Dahlsten called the meeting to order at 3:05PM.

Present:

Donald Dahlsten, Chair
Iral Ragenovich, Past Chair
R. Ladd Livingston, Treasurer
Boyd Wickman, Chair, Founders Award Committee
Mal Furniss, Chair, History Committee
Jan Volney, Counselor [1995-96]
Ann Lynch, Chair, Program Committee
Bill Schaupp, Chair, Local Arrangements Committee
Steve Burke, Pherotech
Carroll Williams, Secretary

Copies of the minutes of the Executive Committee Meeting (March 7, 1994), Initial Business Meeting (March 8, 1994) and Final Business Meeting (March 10, 1994) of the 45th Annual Meeting were distributed at the meeting. Bill Schaupp called attention to the misspelling of his name in the minutes of the Final Business Meeting. Boyd Wickman amended those minutes at section number 4, from "Boyd Wickman spoke his belief" to "Boyd Wickman presented the consensus of this workshop" etc. Boyd Wickman also requested that item "c" of section 8 on page 2 of the Final Business Meeting read: "Boyd Wickman for Founders Award Committee replacing LeRoy Klein". Wickman further requested that the first sentence following Founders Award Committee, section 6 of the March 8, 1994 minutes include the words following Klein: "who resigned and was replaced by Boyd Wickman".

1. **Memorial Scholarship Awards.** Steve Burke suggested pooling all contributions for memorials into a single scholarship award, i.e. the Mark McGregor Memorial Award and the new WFIWC Memorial Scholarship Fund be one account. A discussion ensued with persons volunteering to check this suggestion with the McGregor family. By consensus the Executive Committee places this matter on the agenda of the Initial Business Meeting and would like it voted on at the Final Business Meeting.

2. **Future WFIWC Meetings.** Chair Don Dahlsten reviewed the locations of future WFIWC meetings:

a. The 1996 North American Forest Insect Work Conference will be in San Antonio, Texas. This meeting includes the WFIWC, and will be hosted by the Southern Forest Insect Work Conference, April 15-18.
b. The 1997 WFIWC will be held in Prince George, British Columbia.
c. The 1998 WFIWC will be held in the Intermountain Region.

The Executive Committee discussed joint meetings with the forest pathologists, and proposed we meet every five years with the pathologists, with the next joint meeting in 1999.

3. **WFIWC Resolution on The Importation of Logs.** Chair Don Dahlsten asked about the status of the resolution. Past Chair Iral Ragenovich replied that the resolution was never sent to the various responsible agencies, and now the issue is moot.

4. **Treasurer's Report.** Treasurer R. Ladd Livingston distributed copies of financial tables describing the activities and balances of several accounts and funds as of March 21, 1995:

Checking Account Balance--------------------	2972.92
Checking Account Time Deposit--------------	6135.26
McGregor Fund---------------------------------	819.41
McGregor Fund Time Deposit-----------------	2059.96
Memorial Fund---------------------------------	1097.97
Total	$13085.52

Treasurer Livingston also reported there are still funds outstanding for the Albuquerque Meeting.

COMMITTEE REPORTS

1. **Common Names Committee.** No activity planned.

2. **History Committee.** Boyd Wickman read the report of the committee covering March 1994 to April 1995 (attached).

3. **Founders Award Committee.** Boyd Wickman reported no recipient was named for the award this year, and no recommendations for the award were received. The Executive Committee discussed the process and timing of mailing solicitations to the membership and the deadline for receipt of nominations by the Founders Award Committee.

Boyd Wickman further reported that Staffan Lindgren is not leaving the Awards Committee, but John Neises and LeRoy Kline are leaving the committee. Boyd Wickman nominated Jill Wilson for the committee. Seconded by Ann Lynch. All approved.

4. **Nominating Committee.** A Nominating Committee was formed by Chair Don Dahlsten to recommend names to replace people leaving the various offices of the WFIWC. This committee consists of Jan Volney, Chair; and Ann Lynch and Boyd Wickman. The offices to be filled are Counselor and Secretary.

OTHER BUSINESS

1. **Local Arrangements.** Bill Schaupp described various program features and arrangements for the Rapid City Meeting. He described the location of downtown facilities relative to the Alex Johnson Hotel, discussed possible alternatives to the field trip in case of impassable snow conditions and mentioned the substantial assistance of Tom Juntti in making the arrangements. Bill Schaupp also announced that Frank Cross, the District Ranger from the U.S.D.A. Forest Service Harney and Pactola Ranger Districts will welcome the WFIWC Meeting to the Black Hills National Forest, and will also host the field trip.

   Bill Schaupp and Ann Lynch talked about the need to develop a list of activities, chores, deadlines, and suggestions on how to handle meeting arrangements for the WFIWC.

   Ann Lynch expressed her concern for the lack of addresses in Mexico for possible attendees from that country. The Executive Committee discussed the problems Mexican forest entomologists have in attending WFIWC meetings.

2. **Announcements From the Chair.** Chair Don Dahlsten announced the status of members:

   Deceased: Leon Pettinger

   Retired: Ken Lister, Herb Cerezke, Dave Grimble, and Dave Wood.

   Chair Dahlsten introduced Lea Spiegel and announced that she is believed to be the first forest entomologist for the state of Wyoming.

Chair Donald Dahlsten adjourned the Executive Committee at 4:50PM.

Minutes prepared by Carroll Williams, Secretary, and edited for formatting by Ann Lynch, succeeding Secretary.

WESTERN FOREST INSECT WORK CONFERENCE
46TH ANNUAL MEETING
RAPID CITY, SOUTH DAKOTA

Minutes of the Initial Business Meeting
April 25, 1995

1. Chair Donald Dahlsten called the meeting to order at 8:07AM, and announced the status of members:

    Deceased: Leon Pettinger, Maxine Moyer.

    Retired: Ken Lister, Herb Cerezke, Dave Grimble, and Dave Wood.

2. Minutes of the 1994 Final Business Meeting, and of the 1995 meeting of the Executive Committee were read by the secretary Carroll Williams.

    Jan Volney moved: "Approval of minutes as read".
    Ann Lynch seconded the motion. All approved.

3. **Treasurers Report.** Treasurer R. Ladd Livingston presented a summary of the balances of the several funds under his care as of March 21, 1995:

Checking Account Balance	2972.92
Checking Account Time Deposit	6135.26
McGregor Fund	819.41
McGregor Fund Time Deposit	2059.96
Memorial Fund	1097.97
Total	$13085.52

Copies of the full financial report consisting of tables describing the activities and balances of WFIWC funds were distributed at the Executive Meeting. Ladd Livingston indicated an approximate outstanding balance of $6000.00 for the Albuquerque meeting. Costs of the Proceedings for that meeting and the mailings have not been paid.

Boyd Wickman inquired about the status of the tax-exempt request of WFIWC to the IRS. Livingston replied previous records forwarded to the IRS were inadequate and that he is preparing an additional set to support the tax-exempt request.

John Dale moved: "Approval of Treasurer's Report"
Mal Furniss seconded. All approved.

COMMITTEE REPORTS

1. **Common Names Committee.** The report of the Common Names Committee was written by Chair, Torolf Torgersen and presented by Mal Furniss. The Committee membership includes Lee Humble, Robert Lavigne, Judith Pasek, Iral Ragenovich, John Stein, Larry Stipe, and Chair Torolf Torgersen.

    Previous Actions—Applications for a name change of "boreal spruce beetle" for Dendroctonus punctatus by Malcolm Furniss was resubmitted via WFIWC Common Names Committee to Entomological Society of America [ESA] Names Committee on October 7, 1993. The original submittal of April 1992 had been lost by the ESA committee which had changes it's Chairperson. The name change was adopted by ESA and published in the ESA Newsletter, Vol. 18, No. 1, January 1995.

    New Actions—No new applications for name changes and new common names.

2. **History Committee.** The committee report was read by Malcolm Furniss. He reported that generally, he and Boyd Wickman agreed the first priority involved locating, cataloging, publicizing and preserving historical resources; especially—those of the Forest Insect Investigations in the Bureau of Entomology and Plant Quarantine ca 1902-1953. Sandy Kegley of Region 1, Forest Pest Management (FPM), Coeur d'Alene, accepted the task of cataloging several hundred unpublished reports in Region 1 files; many were issued by the four western laboratories prior to 1953.

    Boyd Wickman and Tom Swetnam are publishing results of tree growth studies in the Blue Mountains of Oregon. Mal Furniss, Boyd Wickman, and Nancy Rappaport wrote an article for "Historyline" on historical photo files, which illustrate insects, forest conditions, control work, and personnel of the early years of the Bureau of Entomology in California and southern Oregon. Mal Furniss is acquiring material for a biography of Walter J. Buckhorn, a renowned associate of Paul Keen and other forest entomologists. Mal Furniss has written a manuscript on the pioneer work of A.D. Hopkins and J.L. Webb involving the outbreak of the pine destroying bark beetle [Dendroctonus ponderosae Hopk.] in the Black Hills, ca 1897-1907.

3. **Founders Award Committee.** Boyd Wickman reported no new nominations have been received by the committee for the past two years. He promised to get the request material packets for nominations out to the membership by June 1995 to provide more time for the documentation process. Jesse Logan inquired about criteria for nominations. Ann Lynch asked the names of past recipients to date. They are Mark McGregor, Dave Wood, Ron Stark, and Gene Amman. Ann

Lynch subsequently asked if instructions for the nomination process be included in the Proceedings.

4. **Local Arrangements Committee.** Bill Schaupp described and explained the contents of the registration package. The hand made map presents the location of various points of interest relative to the Alex Johnson Hotel. The hotel has access to exercise facilities, and the hotel restaurant will serve breakfast starting at 6:30AM. Schaupp presented details of the "Fun Run" event, which will start at 5:30PM. Ladd Livingston inquired about the field trip itinerary. Schaupp replied that there are some storm warnings for the day of the field trip and the field conditions will be monitored.

5. **Program Committee.** Ann Lynch presented changes in program schedules. Tom Eager will replace Jose Negron in leading the workshop on Systematics. The deadline for workshop summaries is June 15, 1995. Ann Lynch indicated a preference for electronic mail in "Word Perfect" or "Data General". No complicated tables please on Data General. Include phone and fax numbers, and E-mail addresses; they will be published in the Proceedings. Ladd Livingston mentioned members need to check the accuracy of their addresses on the printouts located at the registration table. Ann Lynch will try to validate the various addresses; Dave Roschke will help her in this endeavor.

FUTURE MEETINGS

1. **The 1996 WFIWC Meeting**—Ron Billings announced the 1996 WFIWC Meeting will be part of the Second North American Forest Insect Work Conference, which will be held in San Antonio, Texas on April 8 to 12 at the St. Anthony Hotel. The theme of the 1996 meeting is "Vision 20/21". The 1996 meeting will be chaired by Billings and Evan Nebeker. Ron Billings gave a slide preview of the meeting, which included names of the Steering Committee, several are from Mexico. The slides also described the program and points of interest and recreation in the San Antonio area.

Chair Donald Dahlsten gave the sites of subsequent future meetings:

2. **The 1997 WFIWC Meeting** will be held in Prince George, British Columbia.

3. **The 1998 WFIWC Meeting** will be held somewhere in the Intermountain Region.

4. **The 1999 WFIWC Meeting** is a possible joint meeting with the pathologists. The details will be worked out and information will be presented at a later date.

OLD BUSINESS

Chair Donald Dahlsten recognized Steve Burke of Phero Tech who said the Phero Tech now endorses the idea of combining the Mark McGregor Memorial Award and the WFIWC Memorial Scholarship Fund. This is contingent on approval of McGregor's parents. Members discussed the advantages of a single memorial fund. It avoids confusion, fragmentation of funds, and delays in attaining a critical mass or amount required to be sustaining in the allocation of awards. Names of deceased that funds are donated for could be inscribed on a plaque.

John Moser inquired how memorial funds are being invested; he then went on to recommend they be invested in mutual funds. Ladd Livingston replied they are not invested in any fund at this time since the totals are still small. Livingston, Burke, and others expressed their reservations about investments at this stage.

Ladd Livingston indicated the Penticton Meeting Proceedings are now out and extra copies are available. A sign-up sheet is on the registration table for those who wish a copy.

NEW BUSINESS

Ann Lynch reported that Proceedings of the WFIWC Meetings are generally not available in western libraries unless they are donated by members. She went on to say they contain important historical information on people, important insect, and forest management issues. However, the Proceedings are not considered publications by the members.

Ann Lynch moved: "That the WFIWC Proceedings be sent to the libraries of the western U.S. Forest Service Experiment Stations, the Canadian Forestry Research Centres, U.S. Land Grant Universities, and appropriate Canadian Universities." John Dale seconded the motion. Chair Donald Dahlsten said the vote on the motion will be postponed until the Final Business Meeting.

John Moser asked Chair Dahlsten if there is a committee established to explore and discuss a merger of WFIWC with the pathologists? Chair Dahlsten replied that no committee exists, but the matter has been discussed with the pathologists and they are not interested.

John Moser moved: " That a committee be established to explore merger with disease group". Motion died for lack of a second.

John Schmid suggested that if the memorial funds do not appreciate fast enough perhaps some portion of the certificated deposits could supplement them. Ladd Livingston replied that the suggestion had been made and discussed several times in the past, and essentially rejected.

Ron Billings reminded the members to fill out the questionnaire for the 1996 San Antonio meeting enclosed in the registration packet.

Ann Lynch reminded the membership that the workshop registration sheets needed to be completed.

Jan Volney moved: "Adjournment"
Jesse Logan seconded. All approved.

Meeting adjourned at 9:05AM.

Minutes prepared by Carroll Williams, Secretary, and edited for formatting by Ann Lynch, succeeding Secretary.

WESTERN FOREST INSECT WORK CONFERENCE
46TH ANNUAL MEETING
RAPID CITY, SOUTH DAKOTA

Minutes of the Final Business Meeting
April 27, 1995

1. Past Chair Iral Ragenovich called the meeting to order at 8:15AM in the absence of current Chair Donald Dahlsten.

2. Secretary Carroll Williams read the minutes of the Initial Business Meeting of the 1995 WFIWC. The minutes were amended by Ladd Livingston regarding the use of certificated deposits to supplement memorial funds, which has been rejected several times by the membership.

   Bill Schaupp moved: "Approval of the minutes as amended".
   Laura Merrill seconded the motion. All approved.

3. Chair Donald Dahlsten joined the meeting during the reading of the minutes.

AUDIT

Chair Donald Dahlsten announced that he and Past Chair Iral Ragenovich audited the books of the organization and found them to be in order.

OLD BUSINESS

1. Chair Donald Dahlsten established a committee on Memorial Awards:

   Steve Burke, Chair
   Karen Ripley
   R. Ladd Livingston
   Boyd Wickman

2. Chair Donald Dahlsten reopened the motion made by Ann Lynch at the Initial Business Meeting—"That the WFIWC Proceedings be sent to the libraries of the western U.S. Forest Service Experiment Station, the Canadian Forestry Service Centres, U.S. Land Grant Universities, and appropriate Canadian Universities". Peter Hall requested that Provincial Forest Services be included. Motion passed with one objection.

   A discussion ensued about appropriate places to send the Proceedings of the WFIWC since some libraries and agencies may not archive them. Ann Lynch suggested a committee be established to find out which universities and agencies would archive the Proceedings of the organization.

Chair Donald Dahlsten established a Committee on Conference Guidelines and Proceedings. The committee consists of:

Ann Lynch, Chair
Bill Schaupp
Terry Shore
Jill Wilson

FUTURE MEETINGS

1. **The 1996 WFIWC Meeting** will be part of the Second North American Forest Insect Work Conference and will be held at the St. Anthony Hotel, San Antonio, Texas on April 8 to 12, 1996. It will be chaired by Ron Billings and Evan Nebeker.

2. **The 1997 WFIWC Meeting** will be held at the Prince George Civic Center, British Columbia, the week of April 16. Peter Hall will be the Program Chair, and Staffan Lindgren will chair the Local Arrangements Committee.

3. **The 1998 WFIWC Meeting** will be hosted by the Intermountain Region, possibly at Jackson Hole, Wyoming—as reported by Barbara Bentz.

4. **The 1999 WFIWC Meeting** is a possible joint meeting with the pathologists. The details will be worked out and information presented at a later time.

REPORT OF THE NOMINATING COMMITTEE

Chair Jan Volney reported this year the positions of Counselor and Secretary become vacant, and that Mike Wagner has agreed to serve as Counselor and Ann Lynch consented to serve as Secretary for the next two years.

Peter Hall moved: "Approval of these nominations".
Ladd Livingston seconded. All approved.

OTHER MATTERS

1. Chair Donald Dahlsten commented about the successful meeting at Rapid City, and commended the Program and Local Arrangements Committees.

2. Ron Billings asked the membership not to forget to complete and turn in the questionnaire for the 1996 meeting at San Antonio, Texas.

3. Barbara Bentz remarked on the lack of graduate students at the WFIWC meetings. A discussion ensued with Ann Lynch reminding the membership of the student papers and poster sessions. She also commented that ideas to facilitate student

attendance have been previously rejected by the membership. Mike Wagner mentions problems of student attendance due to location and timing of meetings. Bill Schaupp suggested Memorial Fund Awards could assist in helping increase student attendance. It was asserted that a reduction in registration fees for students would not be significant help. Airline tickets could be prohibitive. Ladd Livingston reminded membership that all of these suggestions have been considered before.

Jan Volney moved: "The meeting be adjourned."
Peter Hall seconded. The meeting was adjourned at 9:00AM.

Minutes prepared by Carroll Williams, Secretary, and edited for formatting by Ann Lynch, succeeding Secretary.

Keynote Address: Custer's 1874 Expedition to the Black Hills: Then and Now

Cameron Ferweda
USDA Forest Service (retired)

Cameron Ferweda was instrumental in conceiving of and conducting a project that has provided much of what is known about pre- and post settlement conditions in the Black Hills. As part of this project, photographs taken during the 1874 military expedition to the Black Hills, lead by General George A. Custer, were paired with photographs taken at the same locations in 1974. Historical information, including journals kept by members of the expedition, was incorporated into this work, as well as information on the current condition of the Hills.

The text of Mr. Ferweda's informative, thought-provoking, and entertaining presentation to WFIWC 95 is not available. He passed away in January 2003. Much of his presentation was drawn from the two references listed below that resulted from the repeat photography project.

Progulske, Donald R. 1974. *Yellow Ore, Yellow Hair, Yellow Pine: A Photographic Study of a Century of Forest Ecology.* Bulletin 616, Agricultural Experiment Station, South Dakota State University, Brookings, SD. 169 pgs.

Progulske, Donald R. and Frank J. Shideler. 1974. *Following Custer.* Bulletin 674, Agricultural Experiment Station, South Dakota State University, Brookings, SD. 139 pgs.

Both the above references may be difficult to purchase or find. A recent treatment of the subject, including many photographs, is as follows:

Grafe, Ernest and Paul Horsted. 2002. *Exploring with Custer: The 1874 Black Hills Expedition.* Golden Valley Press. 288 pgs.

Pine Beetle in Ponderosa and Lodgepole Pines[2]

Gene D. Amman
Retired, US Forest Service

As many of you know, where we are meeting today is an area of historical significance for forest entomologists. A.D. Hopkins described Dendroctonus ponderosae in 1902 from specimens collected in the Black Hills. He called it the pine destroying beetle of the Black Hills. Three years later, Hopkins (1905) gave more details about D. ponderosae, and shortened the name to the Black Hills beetle. As the taxonomy and host relationships were sorted out over the next 60 years, Steve Wood (1963) concluded that the mountain pine beetle, D. monticolae, and D. ponderosae were one and the same species. This species varies greatly in size according to host species, nutrition, and crowding during the larval stage. The common name, Black Hills beetle, seemed too restrictive for such a widely distributed species, so mountain pine beetle was retained for the common name.

The topic I have chosen for my lecture is Silvicultural control of the mountain pine beetle in ponderosa and lodgepole pines. We have come a long way from those early observations of A.D. Hopkins to our present state of knowledge encompassing over 1,200 publications about the mountain pine beetle. I want to emphasize that all of these have been important to our progress. In 1905, Hopkins recommended cutting the infested trees and debarking them. Also, he suggested burning or scorching the infested trees.

Silvicultural treatments specifically directed at the mountain pine beetle in ponderosa pine began in 1938 with a crop tree thinning experiment by Eaton (1941). Unfortunately, his experiment was destroyed by fire a few years later, according to Sartwell (1971). In 1960-61, Hall and Davis (1968, unpublished) reported two small tests of one thinning level on the Modoc National Forest. The unthinned stand was "decimated" by mountain pine beetle, whereas mortality in the thinned portion of the stand was minimal during the first few years of the test.

Sartwell and Dolph (1976) reported thinning stands of ponderosa pine in eastern Oregon. They used four thinning levels and check stands. Five years later, mortality in the thinned stands had been reduced over 90%. During the 1976 to 1982 period, the thinnings were subjected to one of the largest beetle outbreaks of record. Thinnings that were spaced 18 x 18 and those spaced 21 x 21 feet experienced little mortality (Dolph 1982). Closer spacings suffered considerable mortality.

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[2] Delivered by Jesse Logan and subsequently published as: Amman, G.D. and J.A. Logan. 1998. Silvicultural control of mountain pine beetle: prescriptions and the influence of microclimate. American Entomologist 44: 166-177.

To reduce ponderosa pine losses to mountain pine beetle, Sartwell and Stevens (1975) recommended thinning to 150 sq. ft. in the Black Hills. Preliminary results of thinnings in the Black Hills reduced tree losses to the mountain pine beetle (McCambridge and Stevens 1982). Stevens, Myers, McCambridge, Downing and Laut (1974) recommended thinning on the Front Range in Colorado.

In a three-year study in the Black Hills, Schmid and Mata (1992) found no mortality in partial cut stands that had growing stock levels equal or less than 100. In a seven-year study in 70 to 90 year old second growth ponderosa pine on the Lassen National Forest, Fiddler, Fiddler, Hart and McDonald (1989), reported no losses in thinnings that reduced the basal area to 80 sq. ft. Only light losses occurred at basal areas of 100 and 140 when compared to check stands that had basal areas of 190 sq. ft.

Silvicultural control of the mountain pine beetle in lodgepole pine began in the late 1960s with recommendations for patch cutting to create mosaics of age and size classes that would reduce acreage highly susceptible to mountain pine beetle at any one time; conversion of stands to nonhost type (Roe and Amman 1970; Safranyik, Shrimpton, Whitney 1974). D.M. Cole (1978) outlined a number of silvicultural practices to reduce losses to mountain pine beetle.

During epidemic periods, the mountain pine beetle is strongly oriented to large diameter trees, but more so in lodgepole than in ponderosa pine. The correlation of tree mortality indicated that mortality could be reduced by removing large diameter lodgepole from stands (Cole and Cahill 1976).

When the mountain pine beetle does infest a tree in a thinned stand, usually only the single tree and occasionally a nearby tree, is infested. Geizler and Gara (1978) emphasized the importance of tree spacing in switching of attacks from a tree under attack to a nearby tree. If the distance is too great, infestation within the stand will not continue.

In 1978, Cahill reported 2% mortality due to mountain pine beetle in partial cut stands of lodgepole pine. Thirty-nine percent of the trees were killed in check stands. In 1987, McGregor, Amman, Schmitz and Oakes reported the results of a five-year study in Montana involving diameter limit cuts and spaced thinnings in lodgepole. Treatments were the removal of trees 10 inches and larger, and 12 inches and larger DBH, and reducing the basal areas of other plots to 80, 100, and 120 sq. ft. Compared to the 70% and 94% loss of trees in the check stands to the mountain pine beetle, losses were about 10% to 15% except in the 120BA and 12 inch diameter limit cuts, which suffered heavier losses. In 1985, Cole, Cahill and Lessard (1985) reported reducing losses to mountain pine beetle in lodgepole pine on the Shoshone National Forest during the first two years after partial cutting stands. Amman, Lessard, Rasmussen and O'Neal (1988) carried on the study until beetle populations declined. Check stands sustained 26.5% mortality compared to 3% or less in the thinning: consisting of 7-inch, 10-inch, and 12-inch diameter limit cuttings, and spaced thinnings leaving 100 trees/acre.

In Montana, Hamel (1978) attempted to reduce infestation of lodgepole pine by removal of trees that had thick phloem, but the test failed. The basic relationship between attack by the beetle and diameter of the tree could not be altered. The propensity of beetles to be attracted visually to large vertical objects, based on the work of Roy Shepherd (1966), precluded the success of this experiment (Hamel 1978).

These thinning operations have been assumed to increase tree vigor, and undoubtedly they do increase tree growth, but an increase in tree vigor does not occur immediately. Some stands take two to three years to respond (Amman, McGregor, Schmitz and Oakes 1988). Therefore, the idea of change in microclimate, which occurs immediately after a stand is thinned, was introduced to explain the decrease in tree mortality in thinned stands (Bartos and Amman 1989).

Mountain pine beetle flight is affected by temperature, wind speed, and light intensity. In lodgepole pine stands ground temperatures and south side tree temperatures were warmer in thinned than unthinned stands as observed by Bartos and Amman (1989) and Schmid, Mata and Schmidt (1993). North side temperatures were not significantly different from air temperatures.

Light intensity is another factor governing flight of the mountain pine beetle. Roy Shepherd (1966) demonstrated under laboratory conditions that mountain pine beetles increased attempts to fly at high light intensities and increased temperature, conditions that were found in thinned stands (Bartos and Amman). Gray, Billings and Johnsey (1972) observed 59% of beetles flew with the wind, but more flew against the wind when speeds were less than 3.1 miles per hour. No flight occurred at wind speeds of 5 to 6 miles per hour. Observations by Bartos and Amman (1988) showed that wind speeds averaged consistently faster in a thinned than in an unthinned lodgepole pine stand during the hours of 4 to 6 p.m., the hours of most beetle flight observed by Rasmussen (1972), but the overall difference of 1.2 miles/hour was not significant.

Finally, solar insolation that could be responsible for warming the air and creating conduction currents, could carry odors out of, and above, the crown area, making it difficult for a beetle to locate a point source of attractant, either kairomone or pheromone. All of these factors are integrated into the beetles' response when responding to traps baited with aggregative pheromones. Only 5% of the 504 beetles were caught in a thinned stand, having an average basal area of 67 sq. ft., compared to 478 beetles caught in traps in the unthinned stand having an average basal area of 137 sq. ft.

Schmitz, McGregor, Amman and Oakes (1989) caught fewer beetles in passive barrier traps in heavily thinned than in lightly thinned and check stands in Montana, even though large numbers of beetles were flying through the thinned stands. John Schmid and his colleagues Mata, Olsen, Allen, Schmidt, and Vigil conducted a series of studies to answer the question of why beetles make limited attacks only in ponderosa and lodgepole thinnings (Schmid, Mata, and Schmidt 1991; Schmid, Mata and Allen 1992; Schmid, Mata, and Schmidt 1992; Schmid, Mata, Olsen and Vigil 1993; Schmid, Mata and Olsen 1995). They have measured air and bark temperatures, horizontal and vertical wind

speeds, and solar radiation. They conclude that only solar radiation and, perhaps, vertical air movement or turbulence would appear to play an important role in mountain pine beetle selection of particular stands. Therefore, effects that thinnings have on stand microclimate and behavioral response of mountain pine beetle, is far from being a closed subject.

In spite of the large knowledge base for the mountain pine beetle, there is still much to do. Concerning research needs, my list is far from exhaustive, and I acknowledge borrowing freely from the ideas of my colleagues on the Mountain Pine Beetle Project, Jesse Logan, Barbara Bentz, Dale Bartos, Lynn Rasmussen and Ken Hobson. The ecologically most interesting and important processes are little understood. For example, the first is the central question in mountain pine beetle research: What triggers or induces an outbreak: Second, what is the Relationship among fire, root disease, and mountain pine beetle? The third involves the series of events leading to ecosystem recovery following disruption by large beetle infestations. Fourth is the effect that fire protection has had on the extent and intensity of mountain pine beetle infestations. Fire undoubtedly has had greater effect on an ecosystem, but beetle infestations cover more extensive areas than the average fire. Fifth is the question: What are the ecological effects of large beetle infestations in ponderosa and lodgepole pine forests? Sixth: How long is the recovery process following an infestation? Seventh: How is global warming going to affect beetle infestations, and what management strategies will be needed to mitigate those effects? Eighth: What sizes and shape of ecological units and the species mix will be needed to maintain ecosystem integrity? Ninth: What type and intensity of management activities can the ecosystem sustain and remain intact?

As you can see, I have a lot of questions, but few answers. And my questions center on large ecological processes. Many of us here today have laid the groundwork for the next generation to find answers to such concerns. In the current scientific interest in ecosystems, the search may take slightly different and unexpected directions than what some of us experienced in the past. However, one thing is evident: We will need to accept disturbance events as basic to maintaining ecosystem integrity.

I acknowledge my fellow entomologists in these efforts to apply and fathom the reasons behind silvicultural control of mountain pine beetle: Dale Bartos; Dennis Cole; Walt Cole; Donn Cahill; Ken Gibson; Gene Lessard; Ken Lister; Mark McGregor; Les McMullen; Bob Oakes; Judy Pasek; Lynn Rasmussen; Les Safranyik; John Schmid; Malcolm Shrimpton; Dick Schmitz; and Stu Whitney. My wife, Jeanette, has been a constant source of support and encouragement. Also, I acknowledge Fred Knight who opened the door to educational opportunity. I thank my nominators and the Western Forest Insect Work Conference Awards Committee for selecting me for the Founder's Award. I am deeply honored.

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Panel: Historic and Current Pest Management in the Black Hills

Speakers:

Ken Lister, Moderator	USDA Forest Service, retired
Dave Miller	Black Hills State University
Deanna Reyher	USDA Forest Service, Black Hills Nat'l Forest
Bill McCambridge	USDA Forest Service, retired
Judy Pasek	USDA Forest Service, R2 Forest Health
Management	

Synopsis by Tom Eager

Ken began this session by introducing the panelists and explaining the goals of this session. This would not be a "pest management" session per se, but he hoped to put forest health management activities in the larger historical context.

Dave Miller presented information detailing the history of mining and settlement of the Black Hills. In this region "B.C." refers to Before Custer, the U.S. Army expedition led through the Black Hills by Gen. George Custer. This expedition was historically important not only because of the resulting maps and observations, but a remarkable series of photographs were made which have proved invaluable to historians and persons interested in reconstructing historical vegetation patterns.

The discovery of gold in the Black Hills was the watershed event in Black Hills history. Actually there were a total of 4 gold rushes, the first lasting from 1875 until 1879. Unlike many of the previous gold rushes in North America, the need for advanced technology to extract the gold limited the importance of the small operator. Large operations (such as the Homestake Mining Company) were needed to supply the capital and infrastructure needed to access the hard rock deposits.

The second Black Hills gold rush occurred in the early 1900's, but the shortage of labor brought on by World War I brought that to a close. The next big boom came in 1933 when the U.S. went off the gold standard, causing gold prices to double. This period also ended with World War II and is fondly remembered as "the good old days". The latest boom has been a result of the development of open pit mining and continues to the present. The history of this region is a story of economic flow and ebb, but it is ironic that the popular image is of "drunken gunfighters and failed hookers".

Deanna Reyner presented a history of the USDA Forest Service in the Black Hills. This "island of trees" in the Great Plains consists mainly of ponderosa pine stands interspersed with riparian communities and encompasses 1.2 million acres. This area provides recreation, minerals, wood products as well as a scenic background to the region.

The Black Hills Forest Reserve Report was produced in 1897, this document provided information about the resources and ecosystems of the Black Hills during the period of 1847 until 1897. The Black Hills are historically significant due to the fact that the first

sale of USDA Forest Service timber was conducted here. The document entitled "Case I, 1899" served as a blueprint for future timber sales conducted here and elsewhere.

Ponderosa pine is obviously the dominant vegetation in the Black Hills, and the forest is described as having "diverse clumped stand structure with a wide range of stocking and age classes". Mountain pine beetle was recognized as having a significant influence on the stands, this perspective was reinforced by a large mountain pine beetle outbreak at the turn of the century.

Fire suppression has also made a dramatic impact upon stand conditions. Ponderosa pine stands are now more dense, and stands are now dominated by smaller size classes. In addition, riparian communities have been reduced in scope and are less diverse than previously. The historical information available for the Black Hills has proved valuable to managers as an aid in planning and comparing future conditions.

Bill McCambridge presented information on the history of mountain pine beetle in the Black Hills. This area has proven valuable to researchers because it is a relatively simple, closed ecosystem. Again, there are some valuable lessons to be derived from the history of this area.

In 1894 A.D. Hopkins described the impressive outbreak at the turn of the century. He estimated that losses of a billion board feet had occurred and that over 10 million trees had been killed. Hopkins also recognized that most of the losses occurred in the northern half of the Black Hills and that there was a possible connection with the limestone soil types which dominated here.

The years from 1964 until 1976 saw another major mountain pine beetle outbreak which killed 250 thousand trees annually. Changes in mountain pine beetle populations can be described on the basis of amount of brood produced in an average infested host. Increases in mountain pine beetle populations occur when the number of brood emerging from an infested tree is sufficient to attack and produce brood in more than one new host. Rates above 4 newly infested hosts per old host produces exceptional outbreaks. Bill outlined a number of biotic factors which may partially influence beetle population dynamics, but he felt that weather was the dominant factor. Cool temperatures in August appear to greatly reduce the spread of outbreaks.

Logging which occurs during the outbreak appears to have little effect on beetle population dynamics. However, efforts to reduce stand density before an outbreak occurs has been shown to be effective. The critical factor in mountain pine beetle control is economic, the market must be able to support the logging efforts. The mountain pine beetle is "a vigorous beetle" and can persist in stands at endemic levels for long periods of time. It is believed that the patterns of mortality which have been seen in the past will continue for the next 100 years.

Judy Pasek next outlined the role of Forest Health Management personnel in the Black Hills National Forest planning effort. The Black Hills is noteworthy because it was the

first National Forest with a Forest Plan, which was produced in 1983. In addition, it has recently become the first National Forest to complete a Plan Revision.

The most obvious impact upon the 1 million acres of ponderosa pine in the Black Hills is due to the mountain pine beetle. The majority of ponderosa pine stands now are between 80 to 120 years in age, but the Forest Plan calls for a restructuring of age distributions in order to obtain an even flow of timber from the forest. This goal will be difficult to achieve due to the current shortage of the young age class stands. The method by which these goals will be attained will involve little clearcutting, commercial thinning is currently the silvicultural tool of choice.

The re-introduction of fire into the Black Hills is seen as desirable, but the past 50 years of fire suppression makes this a difficult proposition. Current conditions in the Black Hills will result in fires of extremely high intensity. The eventual re-introduction of fire into the Black Hills ecosystem will be a long delicate process.

The range of uses for the Black Hills National Forest range from commodity production to maximization of bio-diversity and recreation of "Ancient Forest". Annual Harvest of timber is seen as a crucial tool in effecting desired ecological conditions as well as providing economic support for the surrounding communities. Timber production goals which are set on the basis of maximization of biomass production are undesirable due to the boom/bust cycle which results. In addition, with maximum bio-production the risk of loss due to mountain pine beetle is greatly increased. Social and political ramifications of timber production are the primary concerns.

The goal of Forest Planning is to determine "What mix of amenities can we have?" Clearly, some objectives are incompatible; it will be impossible to have sustained harvest while converting the Black Hills entirely to "Ancient Forest". The current Forest Plan for the Black Hills is an attempt to satisfy the needs and desires of forest users while protecting the resource values for future generations.

Panel Presentation: One Hundred Years of Mountain Pine Beetles in the Black Hills

William McCambridge
Retired, US Forest Service

1894-1908 About 80% of pine west of Spearfish Creek to the Wyoming line was dead. Hopkins in 1905 reports 700,000,000 to 1 billion board feet killed during the epidemic.

1909-1914 Scattered infested groups.

1916-1919 Salvage logging.

1921-1929 Relatively little damage, but beetle present and some salvage logging being done.

1930-1931 Scattered groups of infested trees.

1932-1933 No serious infestations. Beetle infested trees few and scattered.

1933 Beetles increasing in the northern "Hills" but *Ips pini* very numerous.

1935-1936 Scattered small groups.

1937-1940 Epidemic starts mostly in the northern "Hills".

1941-1942 Scattered groups. Decreasing infestation trend.

1943-1944 Scattered groups.

1945-1955 Epidemic conditions. Vigorous chemical control with orthodichlorobenzene in oil.

1956-1960 Scattered groups.

1961-1965 Epidemic develops. Chemical control carried out.

1967-1974 Troublesome scattered groups. By 1971 many large groups.

Above data by R.G. Thompson "Review of Mountain Pine and other Forest Insects Active in the Black Hills 1895-1974" Special Report R2-75-1.

1975-1977 Epidemic starting. Vigorous chemical control in 1976 plus salvage logging and burning. (Chemical control/ethylene dibromide?).

1978 Beetles epidemic but waning. Most serious in the northern "Hills".

1979 Infestations increasing sharply in Bear Lodge Southern Hills with low beetle activity.

1980 Scattered infestations over the Black Hills.

1981 Beetle populations generally declining except in the northern Bear Lodge.

1982 Some infestations up in western "Hills", high on Bear Lodge with static trend. For the forest in general infestations are low.

1983-1989 Low beetle losses.

1990 A limited epidemic near Bear Mountain. Otherwise losses are low.

1991-1992 Epidemic increases sharply in 1991 and continues in 1992. Weather (?) may contribute to some beetle decline in 1992.

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Information for the Western Forest Insect Work Conference 1995.
Rapid City, South Dakota April 24-27.

An Anecdotal Partial Biography of Ronald W. Stark

Founders Award Address by Ronald Stark
Rapid City, South Dakota, April 1995

I ran across a bit of Chinese philosophy recently which I felt describes in some manner my life and professional career. This story may or may not be according to true Chinese philosophy as it was from an Erle Stanley Gardner's pre-Perry Mason story.

It is symbolized by an elderly man riding a mule backward. His features convey the impression that he has lived a full, rich life, achieved wisdom and developed character. He is filled with a zest for life and for life's adventures in spite of his age. He has achieved this state by believing that the vicissitudes of life are but events which shape man's character—the development of which is the true purpose of life. Whether one is met with good or bad fortune is relatively unimportant. It is the reaction to good or bad events that matters.

A man who suffers adversity and reacts in the proper way, develops character which, in the end run, is an asset so that he has benefited as much as though the fortune were good. He is not swollen with pride over an achievement, nor is he despondent over a defeat.

Because he believes these things he rides his mule backwards, because it makes no difference where he is going. A destination in life is not important. It is only what he does along the way that counts. Man, journeying along the way which cannot be traveled, must never regard fame or wealth as his goal. Only as their acquisition affects his character are they important. One who learns to be indifferent to wealth and fame has gone far towards becoming superior to failure. Wealth and Poverty, Fame and Obscurity, are but forces by which character is shaped. If they are regarded as destinations, one risks his character and the journey through life is failure.

My progression to the exalted role of Founders' Award Speaker has been dictated, unwittingly I assure you, by this philosophy. I offer these anecdotes of my life and career with the hope that they will afford something of use to some of you.

I was raised in Calgary, Alberta, Canada during a time when teachers were authoritarians. Were a student unruly, he was punished, physically, if merited in the opinion of the teacher or the ultimate authority, the principal. I received many hand strappings with a hard leather strap for various infractions during my elementary and junior high years. By high school I had gotten smart. Such punishments were naturally feared but seldom resented because it was the way.

If you played hooky your parents were advised. In chronic cases they were visited by a truant officer. The rule was that ALL children MUST complete elementary school at least. Parents who failed to cooperate with the system were subject to civil action. They seldom objected because it was the way.

Emphasis was on basics, rigorous and preordained. We even learned the simple basics of manual training—what hammers, saws, drills, etc. were used for. I am amazed at how incompetent the current 20-40 year olds are in these matters. New math, finger painting, self-expression, Scotch, black, indio, native American, Slavic, culture classes were yet to incubate in future 'Doctors of Education' programs. Grading was determined by how well you learned the dictated material. If you did not learn a certain percentage (I

think 50%) you FAILED—the big F—and repeated the class the following year. Achievement, good and bad was recognized and rewarded or punished. In most families at that simplistic time, the punishment for failure was greater at home than at school—certainly in our home.

There were two paths to take once one reached high school—the final three or four of twelve or thirteen. One aimed for a Metriculation degree, that was necessary for college and university, or a diploma used, but not essential, to enter a technical training school. There was little or no stigma then to choosing or being forced to the latter. One of the many faults of our current education system is the lack of respect for technical trainees and the inane belief that every child can and should go to a University. We should restore the respect for manual labor and professions such as plumbers, electricians, carpenters and the like. They contribute as much or more to society than the hordes of advertising and media flacks, realtors, salesman and the like. But I digress.

There was little or no resentment or animosity by the parents or the school children about these conditions. It was the way things were and generally believed to be the right way. Professional educators, teachers unions, civil rights advocates, psychologists and sociologists had yet to appear to screw things up. The classroom teachers had authority and flexibility in how they taught. Many were inspiring, truly devoted to their profession—not "8-to-5-ers" as seems to be the case today. Most important, they were not outnumbered by administrators.

I failed two subjects in my senior year. I had, belatedly, fallen victim to the "fun" life. It was 1942, jobs were plentiful to pre-consciption age males and I was happy to land a good job in an oil refinery and content to stay there. My mother, a stern disciplinarian with rock hard knuckles, convinced me that I should make up the two subjects and complete my Matric. Short of running away or suffering a concussion, I had no choice. I took a summer course and squeaked through algebra and chemistry.

That fall, I was accepted into a special army program designed by a politician to create instant officers. They reasoned that a crash course at the University of Toronto, concurrently with Basic Army training, followed by a course in "How to Be An Officer" would fill the need for junior officers to lead troops into battle. (I think this was the precursor to the introductory courses now offered at all Universities to provide credits for their semi-professional athletes). The year in university was enjoyable but I hated every boring moment of the following year in Army training camps. It was excellent training had I become a terrorist or soldier of fortune. Fortunately for me and the Canadian Army they decided that my 20/400 vision was a greeter threat to our troops than to the enemy and I was let loose in 1944. The greatest benefit I received from my military service was two years credit for University and typing skills learned by correspondence with the help of the Salvation Army chaplain.

It was the expectation of my family that I would follow my elder brother's example and become an engineer. Being the agreeable fellow I was, and am, I posed no objection. Two events altered this plan.

First, the Dean of Engineering, after reviewing my High School and Army Course transcripts pronounced that I would be incapable of handling the maths necessary. This was not insurmountable; I could have gone to an American University who accepted almost any Canadian applicant, being in awe of their superior grasp of basics and English or unable to decipher our transcripts. I was, however, engaged to a dance hall girl

(YWCA) I had met at a servicemen's center. Going to the States meant up to four years separation. What to do?

Again, the decision was made for me. Laurie (a Registered Nurse as well as a dancer) had nursed the Dean of the College of Forestry at Toronto. He had rhapsodized over the life of a forester and convinced her it was the ideal life. An outdoor girl and a born converter, she decided she could convert this city boy and suggested Forestry—I once again showed my complaisance and said "Why not." So, in 1944 I enrolled in forestry at Toronto.

I found Forestry to be as dull an experience as the Army. The Toronto school was typical of almost all forestry schools in North America—totally dedicated to extraction of trees at the least expense and damn the consequences. Ecology was considered the "garbage pail of science" if considered at all. It is indicative of the glacial pace of change in academia that there has been little change in forestry training. Economics is still paramount.

Valuable lessons were learned there however. I learned that formal education is unrelated to intelligence. A university-trained man can be excruciatingly stupid and a self-taught man can be brilliant and inspirational. I learned chess, a love of history, and some philosophy from such a man while summer cruising. I learned that a true pedant can stretch a concept that can be grasped in several hours to 3 one-hour lectures a week for eight months.

The one and only time I was fired happened during these years. I was a crew chief on a vegetation survey in the Kananaskis Valley of Alberta in the summer of 1947. The forester-in-charge, a typical forestry graduate, informed us that we would cruise on Monday, Tuesday, Wednesday, Thursday and map our results on Friday. By the third week we had accumulated enough data to keep us mapping for a week. A not unusual June snowstorm hit us on a Monday—visibility zero. Being in Alberta, with only 10 inches precipitation a year, we naturally had no rain gear. Being Monday, we were trucked to the survey area. All notes of all crews ended a sodden mass. Tuesday, the snow was worse. I suggested to the boss that we map.

"Monday, Tuesday, Wednesday, Thursday, we cruised, Friday we map" was the response. Same results—any plant less than 6" (Canada was not yet on metric) was buried. By noon, I initiated rebellion and took my crew to a line shack where we played battleships all afternoon. The other crews and the boss were somewhat annoyed when we were picked up dry and cheerful. I was warned that such behavior was punishable by dismissal.

Wednesday dawned (we think); the snow was almost at road closure level. I didn't bother to get dressed for the field thinking in my naïve way that surely now reason would prevail. In came the boss: "Let's go." I took a deep breath (remember I was, then as now, a mild and gentle person used to obeying my parents and teachers) and said in effect "No way." So he told me to get packing. I headed for Calgary and was thoroughly chastised by my father for such behavior. His work ethic was simple—the boss is always right. About 3:00 pm the phone rang and the Regional Forester asked me what the hell was going on. I told him, he told me to get my Ass (he was a rather profane man) back up there. All was sweetness and light the rest of the summer. We worked when the weather was clear, mapped when it rained or snowed.

From this I deduced that when you are in the right, fight! This served me well until I went in higher administration at Idaho. Then I was forced after many defeats, to amend my principle to "When you're right, make sure you can win before you fight!" Also, to adopt the George Will definition: "Diplomacy is agreeing with your protagonist while reaching for a large rock."

Just prior to graduation, chance intervened again. I had received several job offers from forestry industries in the East. I was depressed, because it meant suffering the monotony of commercial forestry amid the hordes of black flies, mosquitoes, horse flies, and deer flies and slogging through the muskegs and impenetrable brush alder of eastern forests. A recruiter from the Forest Biology Division of Canada Agriculture showed up. One of the positions open was at a new forest entomology lab in Calgary, Alberta. I was the most enthusiastic volunteer and got the job. They did not seem to mind that I had had only one course in forest entomology and had received a C or D in it. My professor was Dr. Carl Atwood, an uninspirational teacher but an expert fly tie-er and the father of Margaret Atwood, the now-famous author. So began my forest entomology career.

Our first field season was spent in an abandoned Wardens' cabin in Banff National Park. My assignment was the lodgepole needle miner which was in outbreak. It was feared that we might have a situation similar to that in Tuolumne Meadows in Yosemite—the creation of a "Ghost Forest." We had electric light but no water or heat other than a wood stove. Our water came from an adjacent creek—you could drink the water from creeks in those days.

The moths were in flight that year and we tried to determine the egg-laying habits—to no avail. It wasn't until a smart-alec student assistant named Roy Shepherd found the eggs cunningly inserted inside excavated needles that we made any progress.

For my Masters thesis, we had chosen the development of a sampling plan as necessary for studying population dynamics. (Digression--one of my thesis advisors (unofficial) was Dr. Leonard Butler, a gifted teacher. He cleared up the fundamentals of Mensuration (forest measurement) in several hours that took a Forestry professor an entire term to obfuscate.) The method required counting larval mines in thousands of branch tips. I first ran across the practice of 'cooking' data during this exercise. We had several high school students hired to help with the counting. One of the University students advised me that he suspected one of manufacturing data. I tested him and found him incapable of detecting the larval mines. He had, therefore, created his results to fall between his bench mates. Fortunately, we detected this early so little time was lost. He was reassigned with a stern lecture on scientific ethics.

It may have happened again during my teaching career. I hope not. I did get an offer from one graduate student at Blodgett Forest to give me whatever I wanted in the way of bark beetle numbers—again for a sampling method. He was persuaded that a scientific research career was not for him and returned to the College of Education. He has since made a name for himself as an outstanding teacher in a tough high school in the Bay area.

Graduate work was required by the government. It was at their expense, so no problem. During graduate work at Toronto and later at U. British Columbia I learned much about the quality and character of Professors and curricula.

I had been raised on English literature when reading was still in vogue. One of the most inspiring books I had read was Good-by by Mr. Chips. In all the professors I studied with, only two came close to that ideal. Prof. Diamond at Toronto, had a B.A., taught anatomy to med students, history of science and ethics to all. George Spender, M.A. at U.B.C. taught taxonomy and general entomology and was the unofficial advisor to all graduate students. Both inspired because their teaching was not restricted to science but covered living as a scientist. Both were great men, unencumbered by awards and honors.

Most professors were so self-centered that they could not relate to their students. I learned also that the most likeable professor could be the worst teacher and the least likeable the best.

My qualifying orals for the Ph.D. were the most traumatic time of my training. I went in full of confidence but soon lost it. The answers to examiners' questions depended on memory, not intelligence or reasoning power. I found out later this is true throughout much of academia. Nor was my major professor any help—he sat there and let them dissect me. I had gotten on the wrong side of one entomology prof, a recent acquisition from Cornell. I think I was older than him and he went out of his way to show how much smarter he was. An exception was the examiner from the humanities. We got into a lively discussion on the lasting power of Shakespeare and Shaw. I learned later that he had told the others that it was the first science oral he had attended where the candidate know anything about his outside subject.

He recounted an incident where the student had chosen music as his humanities specialty. The questions and answers went something like this:

"What instrument do you play?"
"Don't play one."
"Are you studying composing or conducting?"
"No."
"What is your interest in music?"
"I just like to listen and collect records." (This was BC and BCD—before cassettes and CDs).
"What kind do you collect?"
"Classical."
"Can you tell us your favorite classicist?"
"Mantovani."

As I was leaving, George Spender took me aside, commiserated with me and confided that given the inclination an examining board could fail anyone—including the profs. I was given a second chance and although the Chairman told me later that I had failed again, the committee passed me. I had done well on my defense of thesis—a separate trial and my class work had impressed them. I typed all my external assignments and drew elegant graphs. I thanked the thorough training of George Hopping, our Officer-in-Charge in Calgary for this.

The Calgary lab under George Hopping was an invaluable training ground. He was the son of Ralph Hopping, a Californian transplanted to Canada in the 20s. George edited and re-edited our reports and manuscripts until they were grammatically and

factually correct. He encouraged us to summarize our data as it accumulated so that it was a short time from completion of an experiment or study to publication. We were also fortunate in that Canadian science maintained close ties to European work and our training included regular review of what was going on worldwide. Also, at University we had to learn to read two (later reduced to one) foreign languages so we were not dependent on reviewers' interpretations for much of the literature.

The Forest Biology Division at that time was headed by Dr. DeGryse, a Belgian with a good sense of humor and a talent for encouraging young scientists. He gave me valuable advice just prior to my first presentation at an international meeting. It was the 10th International Congress of Entomology in Montreal. Sensing that I was approaching hyper-space, he said: "Stark, when you get up on that podium, remember you know more about the lodge pole needle miner than anyone there. Also, before you begin, look over the entire auditorium and imagine them all sitting on toilet seats. It never fails!" It does help.

My first exposure to the relatively new WFIWC was in the early 50s. It was held in Moscow, Idaho, of all places. There I met the big names—Paul Keen, Ralph Hall, Bob Furniss and others. I gave a report on a sampling system I had devised for the needle miner. I remember it was thoroughly panned by the Americans. The hard time I had was softened as it led to an excursion to Yosemite National Park to compare needle miners and learn from their "experts." John McSwain, a brilliant and tragic figure, was there with a graduate student named Don Dahlsten. George Struble was my Forest Service host. Dahlsten was an impressionable city boy at the time. (Can you imagine him at this stage?) I remember McSwain and I swapping wild animal stories (mostly fibs) and then scaring Don by sneaking up on him after a trip to the loo.

We had developed a short cut sampling method for the needle miner and in cooperation with Bob Stevens set out to test it at Yosemite. It was based on sequential sampling, a method adapted from quality control techniques, and categorized populations as Light, Medium or Heavy. We asked George Struble to take us to areas which he thought fitted these. Imagine our delight when the sampling system worked. George was a gentle, polite man of deliberate speech. Over our field lunch he held his counsel while we youngsters gloated over our success. Finally he said: "I can't understand why we need to go to all the bother of cutting off those twigs and counting larval mines when I can tell you the severity of defoliation by visual inspection of the stand." We were nonplussed for a moment but then responded: "You're absolutely right, George, but then you won't always be around to ask."

Apparently instigated by John McSwain, in 1958, I was approached by UC Berkeley to apply for a position there. The incumbent, Art Moore, was being riffed or wanted out—I think the gaggle of students he had were getting to him. I was interested for several reasons; I still had an idealistic view of the academic world in spite of my graduate experience, Berkeley was ranked the top school then, my salary would be doubled (from $6M to 13M), the Bay area was a major attraction then and there was a move afoot to transfer the Calgary lab to Edmonton, a place where no native Calgarian wanted to live or die.

I was required to give a staff seminar and, according to McSwain almost blew it when I described the lodgepole needle miner as resembling a clothes moth! UCB was heavy in taxonomy then, and the statement outraged several profs.

I was impressed by the candor of the Dean of the College, E. Gorton Linsley. The appointment was 90% research, 10% teaching; my principal assignment was to be the population dynamics of the western pine beetle. He advised me that since I would be hired at the top of the Ass't Prof rank, that only gave me two years to prove myself because the next rank, Associate was linked to tenure and at that time they had an up or out policy. This step was only achieved by a rigorous examination of performance which was heavily weighted by the number of publications per year—in short the infamous "publish or perish" policy. I pointed out that a serious study of the population dynamics of an insect would not be conducive to many publishable papers in that time. His response was blunt - keep the pot boiling with side studies aided and abetted with the 10 or more graduate students I would inherit. Fortunately, at that time there was a wealth of unmined information easily available. With the aid of my student slaves, I made the grade.

My predecessors' graduate guidance method was to interfere with the students as little as possible. As a result, many were the happiest but most work-delinquent students I had ever met. Exceptions—not including Bill Bedard and C.J. DeMars—were several Forest Service men, Dick Smith, Bob Stevens, Bob Lyons for example. One professor was determined to oust Dahlsten who was trying to complete a Masters without slackening his social life—the Masters' was losing. The decision was delayed to see if the 'new boy' agreed or could whip him into shape. Don responded to gentle persuasion. (I learned later that 'failure' was a virtual NO-NO at UCB or elsewhere—once admitted graduation was almost guaranteed. Only the most exceptional circumstances would permit expulsion).

Although not 'my' student, Dave Wood was in the middle of a passionate courtship. The object of his affection, Caroline, spent more time at the Oxford tract than the students. The others, most of them Forest Service employees, were working at a bureaucratic pace, only slightly more productively than the "playboys of forest entomology"—our nickname.

I approached their rehabilitation cautiously. Although it was foreign to my nature, I joined in some of their customs, such as the two-martini lunches and after-hours pub-crawls. This occasionally got me into hot water. I did not know the argot of Berkeley—"Mary Jane" was a girls name, "speed" was for autos and planes, "joint" was for body parts or low-class drinking establishments; "grass" was for mowing. I did know that the use of marijuana and other drugs was illegal—I was completely out of touch. Several nameless students who participated in student field trips were accustomed to its use and on one trip jeopardized their and my careers by sharing their fun with undergraduate foresters—notorious tattletales. After my tirade, I don't think it ever happened again—at least without my consent.

I ran into a policy argument soon. Dahlsten had just finished the first draft of his Masters thesis and as was the practice, had padded it with everything possible in the belief that the thicker the Mss, the more impressive. I was convinced that since theses were supposed to be a scientific contribution, the proof of which was publication in a reputable journal, the thesis should be written publication ready. I therefore stripped the thesis to its fundamentals (removing about 60% fat in the process). We had a little trouble with the thesis committee but they went along—I was still in the honeymoon

period. My stock and Don's increased in value when the unedited thesis was accepted by Canadian Entomologist with minor revision.

Then I asked to serve on Bob Lyons thesis committee. It was on pesticides, over 200 pages in length and included every reference ever published and dozens of unpublished reports, over half of which had little relevance to the research conducted. Stupidly, I did not check with his major prof but merrily blue-penciled over half the tome—trying to reduce it to publishable state. I think I recommended dividing it into several "chapters" which would constitute several papers. His professor, Hoskins, I think, was furious when Bob showed him my review.

This precipitated a Departmental committee (the typical academic and governmental response) on thesis policy. After many hours of debate, I found to my delight that many profs were supportive and from then on the form of the thesis was left up to the major professor.

Dealing with the Forest Service students was interesting. They were permitted time off to attend classes and the Berkeley station had a clerk whose job it was to make sure that that was what they did. I received almost daily calls to certify that C.J. Demars, Bill Bedard, Bob Stevens, Dick Smith, etc. were indeed in class. I finally appealed to the Director, John Maguire and had that nonsense stopped. At least they stopped calling me.

I learned a lesson in tact early at Berkeley. I was interviewed by a reporter who was doing a study of Forest Service research. He asked me what I thought of that being done at Berkeley. He hit me at a bad time. I had learned that the scientists at the PSW station were not permitted into the labs after closing time—they were in fact limited to 9-5 research unless they had the initiative to do their experimentation elsewhere. There was also a general feeling that one must conform to what was written down in various governmental manuals—almost that their research must support what they thought they knew rather than break new ground. I made the mistake of voicing this as my opinion. He quoted me almost verbatim. Other than good-humored protestations by several F.S. friends (John Maguire and Bob Callahan, neighbors as well) there was no apparent reaction and I gave it little thought.

Ten years later, I found that some higher-ups in the Forest Service had long memories. I had been nominated to be a member of the Committee of Scientists to advise the F.S. on the drafting of regulations for the National Forest Management Act. The list of candidates was made up by the national Academy of Science but the Forest Service had final say. I learned from John Maguire, now Chief, that one of the Deputies had argued vehemently against my appointment to the Committee and my later contracts with the Forest Service proves that black-listing was not policy—just the petty reactions of a few officials.

I cannot leave my Berkeley days (1959-70) without some mention of Blodgett Forest. We were fortunate in having a funding angel—the Walker Foundation—who permitted us to use some of their funds to build a field station there. I don't know whether those of you who have seen it noticed the somewhat wavy lines of shingles on the west side of the A-frame. One night almost all the forest entomologists were at Blodgett so we had a party (not an unusual occurrence) at the Buckeye Lodge—a favorite eating and drinking establishment on the Georgetown Divide. Dave Wood was on tequilas then and had won a lottery or had cashed in some stocks and offered to buy tequila for anyone who could stand it. Most could, up to a point. The next morning,

almost at the point of a gun, Alan Berryman and Imre Otvos were sent up on the roof to continue the work. In addition to several squares of broken shingles, there is a noticeable dip in several of the rows.

Blodgett was the site of the famous oleorein exudation pressure experiment. Two years of measuring the o.e.p of 200? trees at two-hour intervals from spring to fall. To avoid missing readings in the wee small hours we often prevailed upon the friendly owner of the Buckeye Lodge to have private parties long after closing. Some might question the accuracy of the 2 and 4 a.m. readings. Practical jokes were frequent. Dave Wood "measured" the o.e.p. in a dead tree for several days before he caught on.

There are many more Blodgett stories which will have to await my memoirs—if I get around to completing them. Two bear telling here as one shows the character of one of our distinguished colleagues, the other bears on our relations with foresters and the College of Forestry.

The graduate student who offered me manufactured data was—by his admission—a veritable Casanova with several girls panting for his attention. He could not abide weekly absences from the Bay Area so he fell behind in his assistantship obligation. I cancelled all leave for him until he had caught up. After 7 or 8 days he was frantic, creating highly diverting reasons for letting him go but I was adamant. One evening, while we were enjoying the Southern Comfort version of tea and avocado dip, we heard a gunshot. Minutes later, the student came limping to our fireside announcing that he had wounded himself while cleaning his gun. Laurie and our hostess, Arline Tinus, both nurses, examined his foot over his protests and found that the bullet had very carefully passed between his big toe and the adjacent one, just breaking the skin. They dressed the wound and recommended a trip to Placerville for a tetanus shot. The student pleaded to be sent to his own doctor—in Berkeley of course—but I stood firm. John Borden was working with me then so I detailed him to escort the man to Placerville. I warned him that he would be pressured to go by way of Berkeley and he was not to give in under any circumstances. John later told me that he was offered handsome bribes and threatened with everything from removal of specific bodily parts to outright murder; but he was steadfast--scared but steadfast.

The other tale concerns the reputation of forest entomologists in general, the Blodgett crew in particular. The Dean of Forestry, Henry Vaux called me and said that he received a letter from a citizen on the Georgetown Divide complaining about the reprehensible behavior of the forest entomology students and faculty. It cited particular incidents the details of which would take too long to recount or justify—if that were possible. Certainly, nobody had been hurt and no property damage resulted. I asked to see the letter but he would not show it to me; he also claimed it was anonymous. I received a long lecture on how such behavior reflected badly on the College of Forestry, the College of Agriculture and the University of California—there was no mention of how it reflected on forest entomology, apparently it was to be expected. I was asked (warned would be more apt) to keep our reprobates under control. It was suggested that perhaps we should place Buckeye Lodge and Camp Vimer "off limits" for the summer.

On my return to Blodgett, I recounted the incident to friendly bartender/owner of the Buckeye, Robbie Cooper. The end result was that Dean Vaux received several letters from businessmen and barflies in Georgetown telling him in very plain Americanese to "lay off" the forest entomologists. The gist of their comments was that they thought little

of the foresters who seldom stayed or spent a dime on the Divide. "You think you're too good for us locals" was the politest remark. The forest entomologists were portrayed as indistinguishable from the natives, who bought their groceries and other necessities there and were great socializers. We heard no more about it.

Our relationship with the College of Forestry was odd but not unusual. We were asked to provide an elective course in forest entomology and encouraged (by a few) to do collaborative research, but they would not give us a faculty appointment. I thought we were making progress to that end in 1961 or '62 but a social gaffe precipitated by Dave Wood set us back indefinitely. We were attending a fall social of "Forestry's" where the entertainment consisted of faculty and staff telling humorous tales on one another. Such as when Ed Stone fell in the creek. All such evoked hilarious laughter. It came Dave's turn and he demurred, saying that I would recite his favorite joke instead.

For those of you who don't know Dave well, he was one the best audiences a joke-teller could ask for. For certain jokes, no matter how often told, you could always count on Dave to react satisfactorily. The joke in question is a scatological one involving a Mexican bandit, Pancho, a humble peasant and his burro. The punch line is "Do I know Pancho, I had lunch with him." Dave enjoyed it so that to get a laugh from him, I merely had to recite the punch line. Thanks to the L.A. Times and NAFTA it is no longer 'Politically Correct.'

To resume, I was full of joie de vivre so consented. The reaction was similar to that when one emits flatus in church—except for Dave. I'm not sure whether he was laughing at the joke or my discomfiture. It has been speculated that this incident set back the discussion of joint appointments indefinitely.

I did a survey of entomology and pathology offerings in forestry schools in the U.S. and found that entomology and pathology were treated the same almost everywhere. Given the rigidity of Forestry schools and their inability to see the trends in forest sciences and management, the current state of flux in academia and government forest agencies does not surprise me.

My first professional interaction with pathology was the study referred to by Dave Wood last year—the smog—bark beetle study. (Social interaction had begun earlier with killer darts and hearts—entomology was the master of the first, Fields Cobb and Dick Parmeter kings of the hearts game). The study was reported in 4 Hilgardia papers which I believe are among our most significant efforts of that time. What is not widely known is how the final 'theoretical' paper was composed.

We (Fields Cobb, Dick Parmeter, Dave Wood and I) booked rooms at a motel in Lake Arrowhead for a weekend, laid in a suitable supply of refreshments—liquid and solid—and vowed to stay at it until we had an agreed upon draft. Given the propensity of Wood and Cobb to dominate discussions, get sidetracked and to get emotional at times, I was elected moderator and all swore an oath to obey my rulings. It was a tempestuous weekend. Friendships were disavowed, parentages were questioned, scientific qualifications were challenged but we got the job done. It is not a method recommended for adoption except by the intellectually and emotionally secure.

The School of Forestry was not pleased when Fields Cobb began his cooperative root disease studies at Blodgett since these involved the digging of innumerable "heffalump traps" throughout the forest. I haven't been back there since the early 70s but have been

reassured that a significant portion of the forest is still passable and no one has been trapped.

There has been much speculation of why I left the pinnacle of Berkeley in 1970 to go to the University of Idaho (also known to Easterners particularly as U. Ohio, Iowa or Where?). It was not, as some suspected, out of fear. I had concluded that my abandonment at the top of the Sierras by Dave Wood was an accident unintelligible and inexcusable—but an accident and that he had no sinister designs on me.

Nor was it entirely dissatisfaction with the University. I had almost left in 1966-67. I had become disenchanted with UCB over the handling of the student unrest. I felt that the President Clark Kerr had behaved in a cowardly manner and had caused to be sacrificed a distinguished scholar, Chancellor Strong. Our College and Departmental administration had tried to coerce a unanimous support vote for Kerr. During this fracas, a senior research post had opened in Maine. I actually interviewed and tentatively accepted. But reason prevailed. In spite of the fact that it would provide entry to the lucrative spruce budworm and gypsy moth troughs, it would also have meant working in the east on an unsolvable problem. I went on sabbatical instead.

On my return from sabbatical the Bay Area was no longer as appealing as hitherto. I was on tranquilizers as well as Rolaids and aspirin. The drive from our home now took an hour—if there were no fender-benders—where it had taken 25 mins. Drug pushers and serious vandalism were reported around our children's school.

The following year, 1969, I was contacted by a selection committee for the position of Graduate Dean/Coordinator of Research at the University of Idaho. Apparently Jack Schenk had put my name in the pot. I was receptive for the above reasons and because—I admit it—I had grandiose ideas of how I could improve the academic world in such a position. The President, Ernest Hartung, was a charmer who knows all the right buttons. Their choice of me was primarily because of my reputation in obtaining funds for research as much as my research accomplishments. The Graduate School was an afterthought—Each College was left to its own devices, the Graduate office was merely a record keeper.

I will spare you the gory details of the internal struggles of higher administration. My education was broadened into areas of chicanery, double-dealing, backstabbing and incompetence that I did not believe could persist in academia. The first five years were tolerable. We did make an impression both in research funding and in graduate standards but the means led to stiffening opposition that eventually stalled progress. Having become disenchanted with the scholastic world I was ripe for offers such as assisting on the Douglas Fir Tussock Moth Program and then directing the western component of CANUSA (Canada- USA Spruce Budworm Research and Development Program).

While at Idaho, I did keep a pinky in research. We had a component of the National Science Foundation Integrated Pest Management Project—the mountain pine beetle component of the three-pronged bark beetle segment. That was a lively time. Walt Cole at the Intermountain station in Ogden, seemed to resent our intrusion into his terrain, perhaps because Alan Berryman and other University 'types' disagreed with many of his groups conclusions. He went so far as to try to scuttle the Symposium we arranged to wind up the project. Cooler Forest Service heads, such as Gene Amman and Al Stage, prevailed.

I had several excellent graduate students join me at Idaho. Dave Kulhavy, now at Nacadoches and recent winner of an E. S. A. teaching award, Yemi Katerere, a Zimbabwean, now Director of their Forestry Division and Bill Kemp, with an agriculture unit somewhere in Montana all reminded me that they were what graduate education was all about—not the self-imposed travails of administrators.

The years spent with the Forest Service on the tussock moth and spruce budworm were enjoyable. They brought me back in touch with most of the researchers I had "grown" with. Our relations had subtly altered, however, since I was now part of the conduit for research support. No matter that funding decisions were made by a screening committee, the focal point for disgruntlement was the Program Director.

On the tussock moth program, I was the assistant to Ken Wright, now retired but working as hard or harder as a volunteer at the PNW in Portland. Although the designated flak-catcher, I could always, if the heat got too intense, let it be known that I was a mere mouthpiece. Fortunately, I did not have to use that play often.

The CANUSA project was more difficult. Having international ramifications, more vocal than substantive, the two components, east and west were over-directed from Washington and Ottawa. I was the perfect candidate for the West. I did not know the rules of Washington bureaucracy and had nothing to lose. According to Bob Lyon, who was then in the D.C. office, my memos, particularly to the unnecessary Washington editor, known familiarly as "Fat Broad," were widely circulated and appreciated but with the caution "not to be emulated." I said unnecessary because we had one of the best in house—Martha Brookes—the surrogate Mother to all the scientists at Corvallis. We finally gained editorial independence when F.B. trashed a paper by one of our eminent scientists, Bob Campbell, which had been edited by Martha. They were able to show what a lousy job (perhaps deliberate) F.B. had done. Her work was then restricted to the eastern seaboard.

I could not become accustomed to the Washington demand for projections on numbers of papers which in the interim of a few weeks became a schedule of publications. The Washington editor tried to put us on the spot by publishing these projections as fact in the international Newsletter. I fired off a particularly nasty memo which earned me an official rebuke from the Station Director—but he had a smile on his face as he delivered it.

I was in the fortunate position of having two expert assistant flak-catchers—Jim Colbert and Russ Mitchell. Russ is now retired but Jim is still crunching numbers in Morgantown. Russ and Jim used to play good-cop, bad-cop for me with F.B. and recalcitrant scientists. I would rant and holler and they would soothe ruffled feathers. It worked surprisingly well.

Editing the final products—the Tussock Moth book particularly, was reminiscent of the Lake Arrowhead-Hilgardia experience. Martha Brookes, Bob Campbell and I spent many days and nights fighting over wording and style. Since then I have never been able to start a sentence with 'however.' Generally, however, we did work well together and had fun exposing snow jobs and deciphering jargon. One classic sticks in my mind to this day. It was a study on spray technology. In a Germanic sentence consisting of about 50 words, physics jargon, all the author said was "When a droplet strikes a leaf it stops." Honest. This seemed so redundant that we thought we had

mistranslated the sentence; so we phoned the author. With reluctance he admitted that that was what was meant.

I've rambled on enough, there are many more pleasurable anecdotes to tell but you'll have to wait for the full text. I've been fortunate in that I was in the right place at the right time with the right equipment. The period following WW II was a fortunate one in which to be active. Money was plentiful, jobs were plentiful, there was a wealth of knowledge to be picked up relatively easily. The decline in support for entomology and pathology and science in general is disheartening. Many blame the various environmental laws imposed on forest management. Forest managers are asked to do too much with too little. This is true but it is not the fault of legislation, in particular—the National Forest Management Act. When the Committee of Scientists submitted their report, they warned that the demands of the Act and subsequent regulations would necessitate large increases in budgets for the National Forests. Congress has not followed through on the funding.

There seems to be a minor revolution brewing in the Forest Service at the grass roots level—perhaps because they now have a biologist rather than an economist in charge. At a meeting of a 100-plus district rangers and managers from Montana and Idaho the consensus was that more authority at the district level and less bureaucracy was needed. Cuts—if any are required—should be at the Washington and Regional Office levels, not at the Forest level.

Although it is difficult to believe the papers—particularly when reporting Washington politics—there appears to be hope for the future. According to the Spokesman-Review (that's a paper in Spokane, Washington—you know--in the Northwest—east of Seattle) the Gore "reinventing government" program proposes to cut Forest Service red tape in half. The Forest Service has been designated a "reinvention laboratory" (Don't you love Washington jargon?), a guinea pig for other federal agencies on how to become leaner and meaner. Depending on your level of optimism or pessimism this could be good news or bad news. I'm an optimist, with a strong streak of pragmatism. Given the obvious need for improving the total health of our forest in North America and the fact that the present system is not working to that end—for a multitude of reasons, something's gotta give.

Entomologists and pathologists can influence the end project by accelerating the present trend towards a truly unified approach to forest health strongly emphasizing that to maintain health, prevention is probably more critical than any curative practices. Also to keep in the public and politic eye that forest health is not restricted to bigger and better trees. It includes the water, soil and air and the inhabitants therein.

Since the late 60s there has been increasing integration of forest disciplines in Canada and the U.S. with the goal of increasing forest health. Much has been merely renaming bureaucratic units but also melding of complementary units has occurred. You cannot, however, legislate truly cooperative efforts. The workers have to want to work together.

This conference should—if it has not done so—attempt to define the ideal group, Department, Work Unit, whatever—to achieve forest health. It would start, naturally, with entomologists and pathologists, a soils expert, a hydrology expert, an ornithologist, a wildlifer etc. You see what I mean. You might also want to include the various disciplines dealing with human behavior—to determine how to get them to work together for the common good.

Having tried at least to insert a "message" into what is a largely frivolous exhortation I hope I have achieved the marks of an acceptable speech—somewhat entertaining but with utility as well. I thank you again for the honor and privilege of speaking to you.

Workshop Summary: Landscape Disturbance Measures & Indices

Moderator: John E. Lundquist, Rocky Mt Exp. Stn, USDA Forest Service, Fort Collins

Participants: Carol Bell Randall, Barbara Bentz, Robin Reich

Attendance: Approximately 30 people

Insects and diseases commonly influence landscape heterogeneity, connectivity, process flows, and fragmentation, but studies addressing these kinds of pest impacts are mostly lacking in the literature. In fact, disturbance/conservation ecologists have arguably minimized the potential importance of biotic disturbance agents as factors influencing patterns and processes in natural communities. Forest entomologists and pathologists, in contrast, have dealt extensively with insects and pathogens in natural ecosystems, but these studies have generally been aimed at specific silvicultural objectives (mostly timber harvesting) and not toward a broad understanding of these organisms on pattern-process landscape-scale interactions. In short, pest specialists and disturbance/conservation ecologists do not yet speak the same language, yet they both work on inherently the same subjects. This difference is perhaps most acute by examining the indices used to measure disturbance. The bottom line is that forest managers must be able to quantify and predict disease impact in order to determine if, when, and where activities aimed at managing insects or diseases will be practical. Three panelists examined these issues during this session.

The first panelist was Carol Bell Randall (R1 Insect and Disease Management, USDA Forest Service) who discussed the methods used by Insect and Disease Management (IDM) in Region 1 to assess the roles of insects and diseases in forest management. She summarized her contribution as follows.

The IDM staff in Region 1 has begun development of methods to assess the role of insects and diseases in forest management. Our objectives for developing these methods are to 1) ensure that planning and 2) to demonstrate to forest planners that insects and diseases play an integral and not necessarily detrimental role in forest succession, and the functions being performed by other disturbance agents which perform successional functions within forested ecosystems. What function insects and diseases perform is dependent upon forest composition and structure, forest succession, and the functions being performed by other disturbance agents (e.g., fire, drought, wind). R1-IDM efforts are focused in three areas: 1) describing current functions insects and diseases perform in forested ecosystems, 2) comparing current functions to functions that insects and diseases historically performed, and 3) describing a range of spatial and temporal scales and forest conditions in which insects and diseases perform certain functions.

The methodology being developed involves a combination of data management, spatial and non spatial data analysis, and modeling. A data array of insect and disease function indices was built for subcompartment stands from a 1974 sample of subcompartments representing 6 national forests in northern Idaho and western Montana. The 1974 data and indices are being compared against stand data from the 1930's for the same land units. The change in forest composition and

structure from the 1930's to the 1970's is being examined considering what would have been feasible given successional processes alone (as modeled by stand and trees models), and then considering succession and the functions that insects and diseases are known to play in those forests (by modifying stand and tree growth models to incorporate insect and pathogen effects). Models modified to incorporate the effects of insect and disease disturbance. An effort is underway to package all of these steps into an automated system so that future analyses to predict successional changes can be done much more quickly. These analyses are expected to occur at a series of spatial scales from the forest service district level to the regional level. To date, analysis has involved the use of the Oracle Data Base Management System, the Arc/Info Geographic Information System, the ArcView2 data display tool, and the Forest Vegetation Simulator. The goal is to use these or similar tools to create a system that will be available for wide spread use on the project 615 platform.

The second panelist was Barbara Bentz (Intermountain Research Station, USDA Forest Service) who discussed disturbance indices and insects in forest ecosystems from a research perspective. Her summary of the presentation follows.

Many National Forests are currently amending or revising their forest plans. Ecosystem management, which is fundamentally connected to forest health, is a vital core of these plans. Although the term forest health has been defined many ways, one definition assumes a healthy forest if conditions are within historic norms and amplitudes, e.g. pre-European settlement. Native insects are an integral part of forest ecosystems, and historically have played important roles. Consequently, native insect populations and other natural disturbances should be included within the forest health context as integral parts of a properly functioning ecosystem. Traditionally, however, forest "pest" management has relied on concepts developed in agro-ecosystems, which have very different values and spatial and temporal scales, that focus primarily on eradicating a particular species and therefore protecting a single commodity. Unlike agro-ecosystems, commodities in a forest ecosystem are not simply crop based, but include many other intrinsic values such wildlife and recreation. A native component can not be removed with the expectation that complex interactions, like those found in forest ecosystems, will continue to function properly. The new paradigm in forest management, ecosystem management requires a view ground in systems rather individuals. To do this, we need to understand the conditions and processes that have maintained a particular forest type over time, and include them in the forest planning process at both the stand and landscape scale. We are beginning a project using many pieces of evidence, including dendrochronological techniques, to understand the pattern of bark beetle population behavior prior to European settlement. One way this information can be used is in developing disturbance indices for use in forest planning. A goal of this workshop was to define disturbance index. Toward that goal, I envision a disturbance index that would encompass the constant, disturbance-mediated change occurring in forest ecosystems, and would include values such as frequency, intensity and return interval of disturbances on a given site. It is important to note that these indices would only be relevant at the landscape scale (rather that the stand), and should be ratios to facilitate comparison across landscapes. Ideally this type of index will provide an avenue to discriminate between ecological disturbances that are pathologic symptoms of ecosystems out-of-balance from those in which the disturbance is a manifestation of a properly functioning ecosystem. In this manner we can begin

to include the positive aspects of insect-caused disturbances on forest succession into the forest planning process.

Spatially referenced analyses have not been widely used in research or management of forest insects or pathogens. Relatively recent developments in GIS and remote sensing have provided several potentially useful tools for analysis of these types of data.

The third panelist was Robin Reich (Department of Forest Sciences, Colorado State University) who discussed combining spatial statistics with GIS and remote sensing in modeling forest disturbances. His summary of the presentation follows.

An important problem facing resource managers is the integration of several types of data when modeling the spatial dynamics of biological populations such as Armillaria root disease and mountain pine beetles over large geographical areas. There are two aspects to the problem: firstly, the integration of data from different sources at a high enough resolution, and secondly, modeling the spatial dynamics of the population of interest.

The first aspect, data integration, has been researched extensively during the last decade. The most widely accepted procedure of integrating spatial data is the use of geographic information systems. Geographic information systems allow for the collection , storage, and analysis of objects and phenomena where geographic location is an important characteristic of, or critical to analysis. GIS has been used for a variety of purposes, including the identification of suitable wildlife habitat, timber harvest schedules, modeling biodiversity and population dynamics. Integration of remotely sensed data and geographic information systems is becoming an extremely powerful tool for producing maps of ecosystems. Satellite imagery and GIS have become vital to resource managers in making decisions and establishing policy. The main obstacle in the development of a descriptive GIS model is the coarse-grained resolution of raster data.

The ability to model the small scale variability associated with insect or disease infestation requires the generation of full-coverage maps depicting stand characteristics thought to influence the presence or absence of the insect or disease. While remotely sensed data has been shown to be refined enough to provide reliable information for macro-scale ecological monitoring, it falls short in providing the precision required by more refined ecosystem models. Spatial statistics and geostatistics provide insight in the development of a spatial model that can be used to correlate remotely sensed imagery, or other data available in a GIS data base with field measurement. If, for example, a satellite image is geographically referenced to a base-map, one can overlay the locations of field plots on the image to obtain pixel intensities associated with each of the field plots. Thus, for each sample plot, we have field data describing stand characteristics and seven intensities representing the 7 landsat TM bands. If the field data is spatially correlated with the intensity of the remotely sensed image it is possible to develop a model describing this spatial continuity.

Once a spatial or temporal dependency is established for a given variable (relative density of Armillaria root disease, number of bark beetle infected trees, etc.), this information can be used to interpolate values for points not measured. In most sample surveys, supplemental information is collected in addition to the variable of interest (i.e., average stand diameter, crown closure, food availability, etc.). If these variables are spatially correlated with the variable of interest, this information can be used to improve estimates. The use of auxiliary information in spatial prediction is referred to as cokriging. The usefulness of auxiliary information is enhanced by the fact that the variable of interest is generally under sampled. One of the appealing features of cokriging is that the auxiliary information does not have to be collected at the same data points as the variable of interest. This allows us to combine remote sensing and field data to provide a full coverage map with a higher resolution than would have been possible by using remote sensing and field data alone. In essence, remote sensing images provide information on a large scale spatial variability, while field data provides information on small scale spatial variability.

The second aspect, modeling spatial dynamics, is a more recent development, especially with the increase in computing power which makes it easier to perform intricate computations needed to explore complex spatial patterns. One class of spatial models that has received considerable attention in recent years is the Gibbsian interaction model, which is often referred to as Markov random fields. These models encompass conditional spatial autoregression and a wide class of models for interacting point patterns. The term Gibbsian interaction comes from statistical mechanics, where such models have been used for nearly a century to describe the behavior of gases. In most applications, interactions between events are assumed to be pairwise.

Examples of spatial stochastic models that take into consideration the interaction among events include work on sequential packing models of non-overlapping discs, Poisson cluster models, and Strauss-type and hard-core models. While most of this work has been theoretical, the increase in computing power has contributed to progress in estimating the parameters of these models using theoretical approximations to the likelihood function or computer simulations. Approximate maximum pseudo-likelihood procedures provide reasonable parameter estimates and are somewhat easier than approximate maximum likelihood. Nonparametric estimations of pairwise-interaction point processes for similar problems have also been developed.

These spatial models can be integrated with the GIS to allow one to introduce environmental heterogeneity into the model, and allows us to describe the spatial interaction between species both on a local and regional level. Such a model may be useful in simulating the effect that changes in the landscape have on the spatial dynamics of the population under study. By changing the environmental conditions, the model can be used to study the spatio-temporal behavior of the population as it converges to a new state of equilibrium, as well as obtaining insight about the relationship between environmental heterogeneity and species distribution. This approach to modeling the spatial dynamics of an individual species, or group of species with their habitat can be used in a variety of application sin which sufficient data is available. The information

derived from such a model will undoubtedly benefit researchers interested in ecosystem processes by providing a better understanding of the influenced of large- and small-scale spatial variability on the abundance and productivity of selected forest pests.

Workshop Summary: Successful Applications of Forest Pest Research

April 25, 1:45 - 3:15

Moderator: Peter M. Hall

Attendees: Approx. 18 representing primarily universities and research agencies.

The workshop was not formally structured; it was intended as an open discussion on the characteristics of successfully implemented research efforts. Some reasons for implementation "failures" were also examined. Basic research providing background or initial data in general areas of interest was not considered in this workshop, only research directed at resolving a perceived problem was discussed. The criteria for evaluating successful implementation of basic research are substantially more complex and indefinable than those for operational research. Good discussion ensued and the workshop closed at about 3:00.

Examples of research efforts that have been successfully delivered and implemented in operational programs include the following:

- the use of annual pheromone monitoring programs and application of nuclear polyhedrosis virus for Douglas-fir tussock moth;
- the use of semio-chemicals (particularly aggregation semio-chemicals for bark beetles such as the mountain pine beetle;
- "beetle proofing" techniques and strategies;
- development and use of hazard rating systems for a variety of bark beetles and other potential damaging agents; and,
- use of *Bacillus thuringiensis* Kurstaki as a replacement for conventional chemical insecticides.

There appear to be a number of reasons why some avenues of research are more successful than others in terms of successful implementation. In general, regarding the examples noted above, the successful implementation was due to early and close cooperation between a management agency and one, or more, coordinated research groups. The initial problem was identified by the management agency and research planning incorporated the management agency's policies and operational capabilities.

The research group(s) were coordinated and the research effort was planned from the beginning. Field trials involving the management agency were incorporated into the effort and effective training and technology transfer mechanisms were established.

In short requirements include:

- identification of a management problem to be resolved;
- clear definition of the problem and feasibility of various operational approaches;
- a coordinated and dedicated research group with adequate resources; and,

- a management agency with the interest, ability, will, and resources to carry the project through.

There are also impediments to the implementation of forest health research. Various lines of research have not been incorporated into operational programs. The reasons for these "failures" are varied, but include the following:

- research topics are chosen and prioritized by research agencies without substantial consultations with management organizations;
- research into management methodologies sometimes dwell on approaches that are not consistent with standard management ways of doing business or address issues which are not seen as priorities by the management agency;
- implementation of successful lines of research may be delayed or jeopardized by legal restrictions such as the need for a pesticide registration;
- promising research results and approaches may not be accepted by management agencies due to "corporate inertia" or a lack of understanding; and,
- technology transfer mechanisms may not be adequate to ensure wide dissemination of information.

Workshop Summary: Issues of Concern to State and Private Forestry

Moderator: Richard Dorset, South Dakota Division of Forestry, Pierre, SD

Attendance: Approximately 25 people

Forest Service Reorganization - Ann Bartuska, Director of Forest Health Protection, USDA Forest Service, led off an open discussion with a brief update on the status of the current Forest Service Re-invention effort.

Briefly, the Forest Service had its recommendations and review done by the deadline they had been given, March 31. However, the Department Secretary was new and as of this meeting had not yet had time to review the proposals. Even though the proposal is still awaiting final action, the Washington Office (WO) of the Forest Service has done some reorganizing and downsizing.

Basically, the current proposal reorganizes the WO into 5 program areas; the National Forest System, State and Private Forestry, Research and Development, International Forestry, and Operations.

On a Regional basis the re-invention effort is still being worked out. The plan is that each region will, however, be led by a 3 person Leadership Team made up of the Directors of the NFS, S&PF and Research, all housed at the same place. Where Forest Health Protection will fall in each region, and even if it will be in the same place in all regions, is still not decided. How forest health services will be provided in each region is still being worked out. It seems there are even still questions about the name and whether or not it will be the same or different for different regions.

Apparently, there is even still a lot of uncertainty about Cooperative Forestry's role over the next few years. The current congressional mood is that monies going through federal agencies to state agencies should go as block grants and eliminate the federal agency involvement.

Regional boundaries, as well as the number of regions, is also still undecided. The proposal as submitted tried to match the current NRCS (old SCS) boundaries. But, as they are now drawn may be the least likely part of the whole reorganization to be implemented.

The driving force behind much of the reorganization is to reduce the number of personnel in the Forest Service. Overall the FS is aiming to reduce staffing by approximately 3200 more employees from today's level by FY97. The WO alone is planned to go from 880 personnel to 690.

There currently is no time line for decisions to be made or things to be implemented. Everything is waiting on the Department Secretary's review and decisions.

Forest Health Monitoring (FHM) - The EPA portion of FHM may be cut by FY96 as E-MAP budgets have been slashed and their detection programs have been zeroed out for FY96. However, the USFS feels that FHM is how forest health services should be delivered in the future. Forest Health Protection is trying to have their portion of the overall program implemented in all 48 contiguous states by FY97. The states are still being told that FHM funding for this is still supposed to be over and above current cooperative dollars.

Several questions and comments concerning FHM that do not seem to have answers included: Is there a need for a national monitoring effort? Someone needs to take a close look at the scale of any FHM effort and determine who will benefit from the information collected, especially to determine who should pay. It seemed questionable as to whether all 48 contiguous states are going to want to participate, even though Forest Health Protection wants to go in that direction, especially since the states do not want to lose the programs they have now.

Forest Health Terminology - A brief discussion occurred on the term "Forest Health" itself. Comments included; there is a lot of confusion as to just what is meant by "Forest Health"; there is a difference between forest health and ecosystem health which is sometimes overlooked; everyone seems to be using it for just about everything, especially prescribed fire and re-vegetation after fire; there is no agreement on just what it is; from the public perception that terminology appears very popular; Capitol hill staffers like it; the leadership for "Forest Health" is currently in Forest Health Protection.

On a side note in British Columbia the Forest Health group has been moved to Silviculture while in Washington (state) the Forest Health group has been moved to Forest Protection.

Cultural Resources Act - Ron Billings introduced many in the room to some of the requirements of the new Cultural Resources Act. With this new law forest pest suppression or prevention projects using federal funds now have to have archeological approval. In Texas, oak wilt suppression requires trenching between trees, which required an archeological inspection of each site. Another state (moderator's apologies to whoever brought this up as I forgot to write down your name), had to have an archeologist check the chemicals in a spray project to make sure they would not cause more rapid degradation of artifacts than normal. The result of all this is added costs to the projects, only part of which can be paid for by any federal suppression project cost/share dollars.

Western State Pest Managers Meeting - The last item discussed started with communications between and among state pest management personnel in the west. Also, discussed was communications with the Western State Foresters as a group and the need to find better ways of communicating with customers as resources, i.e. personnel numbers, become less and less but the need does not diminish. It seems there is support on the ground or field level for pest management but that does not seem to be getting through to legislatures.

One option considered was to set up an e-mail or internet network system.

The preferred option was to have the group, especially the state pest specialists, get together in a special session as part of the WFIWC agenda. It was noted and pretty well agreed to that this years session was not long enough. Possibilities for next year included having a luncheon or dinner (moderators insert, or breakfast) meeting, having a workshop like this year but asking for a longer time period, having a special 1/2 day meeting either before or after the regular WFIWC meeting.

The most agreed to option would be to have a special session during the Executive Committee meeting just prior to the start of WFIWC. Bob Celaya has agreed to head up or lead next years session, whatever it turns out to be.

As the moderator I wish to extend my deepest thanks to Ann Bartuska for agreeing at the last minute to present the Forest Service re-invention status, for remaining available after a last second schedule change, and for answering all our questions on several different subjects.

Workshop Summary: Pest Models and Decision Support Systems

Moderator: Terry Shore, Research Scientist, Canadian Forest Service, Victoria, British Columbia

Invited Participants: Bruce Hostetler, Entomologist, U.S.D.A. Forest Service, Troutdale, OR; David MacLean, Research Scientist, Canadian Forest Service, Fredericton, NB; Stuart Taylor, Forest Health Operations Forester, B.C. Forest Service

Current use and development of pest models and decision support systems were discussed through presentations by the invited participants and the moderator.

Use of Forest Vegetation Simulator (Prognosis) in Region 6
Bruce Hostetler

In the Pacific Northwest, the USDA Forest Service uses a tree growth simulation model called the Forest Vegetation Simulator (FVS), which can be linked to a number of insect or disease models to simulate effects of these organisms on tree growth. Included are models for western spruce budworm, mountain pine beetle in lodgepole pine, Douglas-fir tussock moth, Douglas-fir beetle, western root disease (*Armillaria* and *Phellinus*), and annosus root disease. In addition, algorithms to simulate effects of dwarf mistletoe are embedded in FVS.

To date, most use of insect and disease models in the arena of decision making has been for specific forest management projects, and not in the arena of forest or landscape planning. In most all of these projects, the models used data which had no spatial resolution, and the silviculture scenarios were predetermined and not altered as a result of the projected effects of insects and pathogens on structure and composition of forest stands.

The primary information that was used by the decision makers in most project analyses in which insect effects have been considered was the benefit-cost ratios which were derived from the marginal differences in resource values between the various management scenarios. These benefit-cost ratios were only part of the decision making process and at times there were socio-political variables which were the driving force behind the decisions.

The models were helpful in making decisions on a project by project basis, but this is not where we see the most value in these models.The models need to be employed initially and throughout forest or landscape planning processes. By adequately taking into account the projected effects of insects and diseases on a landscape scale, we may be able to avert some of the unwanted consequences of insects and pathogens over the landscape.

We are trying to increase the awareness and use of the insect and disease models in several ways:

- Providing training to not only silviculturists, but other specialists with responsibility for wildlife, fish, visual, or recreation resources.

- Involvement in projects which we think can be enhanced through the use of the models (Deschutes National Forest plan; R6UPDATE, visualization project on Sisters Ranger District).
- Involvement in designing the vegetation survey and helping determine which data variables should be collected (this helps us insure that we are getting the base information that we will need to project tree and stand growth in the presence of root disease, dwarf mistletoe, mountain pine beetle, etc.)

In the future there are several areas which I feel are very important if we are going to be using the insect and disease models to their full potential:

- Development of a multiple insect and disease model.
- More "up front" involvement in the forest planning process.
- Collection of vegetation, insect, and disease data which has spatial resolution.
- Increased involvement with specialists for resources other than timber.
- Incorporation of insect and disease models in analysis and decision support systems such as the ones that were mentioned here today and others.

A spruce beetle decision support model
Stuart Taylor

A major spruce beetle epidemic in the Prince George Forest Region in 1990 created the need for a substantial sanitation program and an information system to assist in management activities. The complexity of the insect's life cycle, a mix of both one and two year life cycles, makes it the most difficult bark beetle to manage from a systems perspective.

In 1992 the British Columbia Forest Service initiated an operational system on a geographic base which couples geographic data and systems for rating beetle treatment priorities that is unique in British Columbia. The result is a user friendly and automated system that has received acceptance in four Forest Districts and eight forest companies.The system has been expanded to include three species of bark beetles. Digitized data is currently available for approximately 180 000 ha of beetle infestation of which detailed ground data comprises 56 000 ha.

The results of this project are actively used by the Forest Service and Indu stry to redeploy 1.2 millionm3 of harvest to timber infested by beetle and manage a 2.7$ million beetle program. The results are presented graphically as treatment plan maps which are now integrated as part of the approval process for timber harvest in four Districts. The cost of the system represents less than 3% of the Forest Service's direct control budget for the regionor probably less than 1% of the total control budget if industry expenditures could be accuratelyestimated. The research potential of the system has yet to be utilized but includes the ability to compare land satellite imagery with extensive data from ground surveys.

A Spruce Budworm Decision Support System
David A. MacLean

The spruce budworm decision support system (SBW DSS) consists of a suite of models and interpretation systems, linked to a GIS, that assists forest managers in making decisions regarding pest and forest management planning. It integrates systems for pest monitoring and a population prediction model; spatial risk and vulnerability (severity of damage) assessment models; models predicting long-term stand- and forest-level development and timber supply under alternative pest/forest management scenarios; a protection planning system based on marginal timber supply benefits; an automated dynamic inventory projection system to update inventory data and to allow "what-if" exploration of possible futures; and ultimately, forest management planning options to reduce the damage caused by future spruce budworm outbreaks.The system is being implemented on a Unix workstation using the ARC/Info GIS and a graphical user interface.

Two of the SBW DSS tools are:

1. The Inventory Projection System (IPS) allows evaluation of effects of budworm outbreak and insecticide use scenarios on the forest inventory at user-specified times in the future. Stand dynamics are governed by volume yield curves and a set of rules which determine the effects of two severities of budworm outbreak, protection, and successional changes. Applying IPS to a 32,000 ha forest showed that a severe budworm outbreak and no protection would result in the loss of 371,000 m^3 of spruce-fir timber, and an increase in the proportion of hardwood stands.

2. The Protection Planning System (PROPS) provides a systematic methodology for designing forest protection (insecticide use) under the threat of spruce budworm, based on quantifying the marginal timber supply benefits of protecting stands. PROPS essentially replaces the susceptible forest map currently used in planning spray programs with a marginal timber supply benefits map. A defoliation-based stand growth model (STAMAN) and a timber supply model (FORMAN+1) are used to forecast forest development with and without defoliation. Protection priority (m^3/ha) is then calculated for each stand based on both direct (stand-level) and indirect (harvest queue disruption) marginal timber supply impacts associated with applying protection. This priority value is used as a mapping attribute to generate protection planning maps. A PROPS test on a 275,000 ha license area indicated that the total timber supply saved by protection was 6.4 million m^3 but by concentrating protection on the highest priority areas, 49% of this volume could be saved by protecting only 31% of the area.

A Mountain Pine Beetle Decision Support System

Terry Shore

A DSS for the mountain pine beetle is being developed In British Columbia. The system consists of a number of databases and models linked to a GIS and presented in a user-friendly interface. The GIS is used to import, view and analyze forest inventory maps and databases as well as mountain pine beetle infestation maps and associated databases. This information is used to determine stand susceptibility and risk to the mountain pine beetle as per Shore and Safranyik (1992). Other system components utilizing this information are a population dynamics/impact model, which will model infestation progress and track tree and volume mortality, and an expert system which can be used to select possible management strategies and tactics and then compare their

effectiveness with the population dynamics/impact model. A management database was designed to keep track of ground survey data and management actions. Also included in the system is a literature database for accessing and updating selected literature on various aspects of the mountain pine beetle. The system runs on an IBM-compatible PC and was developed using the PAMAP (Terrasoft) GIS, Microsoft FoxPro and Access database management systems, M4 expert system software and Visual Basic interfaces.

Workshop Summary: East-side Ecosystem Management Project Assessment of the Terrestrial Invertebrate Fauna

Moderator: Roger Sandquist, USDA-Forest Service, Portland, OR.

Participants: Sandy Kegley, John Moser, Christine Niwa, Carol Randall, and Roger Sandquist.

Attendance: 21

The Interior Columbia Basin Ecosystem Management Project (ICBEMP) consists of three concurrent efforts; an EIS team for eastern Washington and Oregon, an EIS team for Montana and Idaho and a science integration team.

These groups were established as a result of the President's Forest Conference held in April 1993. The consequences of dealing with late successional forests as habitat for the northern spotted owl, an endangered species, suggested that work be conducted in the Columbia River Basin east of the crest of the Cascade Mountains. This area has issues concerning the viability of species of anadromous fish, grazing on federal lands and in general, forest health.

The two EIS teams will develop the issues as they relate to their respective areas. The Science Integration Team is responsible for preparing an Ecosystem Framework document, a Scientific Assessment for the entire Columbia River Basin and broadscale and midscale assessments for the two EIS areas and Evaluation of Alternatives for the Environmental Impact Statements.

There are teams working on topics as sociology, economics, rangeland grazing, and aquatics (mostly fish) that aren't mentioned. This workshop focuses on two areas; landscape ecology and terrestrial invertebrate assessments.

Roger Sandquist (substituting for Christine Niwa) reported on work conducted by Hessburg et al. of the Forestry Sciences Lab in Wenatchee, WA. Landscape susceptibility to insect and pathogen disturbances was assessed using standardized photo-interpretations of stereo photo pairs (1:24,000 to 1:100,000) for 337 subwatersheds (10,000 to 50,000 ac) representing forested conditions in the CRB. Hazard characterizations were based on comparisons of recent historical (1920s to 1950s) and current (middle 1980's to present) forest vegetation coverages.

Sets of hazard variables unique to each host-pathogen or host-insect interaction were modeled, and they included such variables as site quality, host abundance, canopy structure, host age or size, host vigor, host density, continuity of host types, topographic setting, and logging disturbance. The insect species modeled were: western spruce budworm, Douglas-fir tussock moth, Douglas-fir beetle, western pine beetle (mature and old ponderosa pine; and immature, overstocked ponderosa pine), mountain pine beetle

(overstocked lodgepole pine; immature, overstocked ponderosa pine; and western white pine), fir engraver, and spruce beetle. All stand polygons in a sample subwatershed were given a rating of low, moderate, or high susceptibility to a species based on the sum of the hazard variables in the model.

Sandy Kegley described what the Northern Region of USDA-FS is doing in conducting insect and disease assessments relating to ecosystem management. They are considering the various functions of insects and diseases and how that affects forest succession and ultimately, fiber production. This information is used in project level and large area (National Forest) plans. Historical and current information can be interpreted to account for the roles and processes of insects and diseases in managing forest succession.

Carol Randall reported on the activity of a ICBEMP group modeling the changes in vegetation over time (10, 50, and 300 years) resulting from the effects of insects and pathogens. Previous insect and pathogen assessments have addressed their effects on resources and their role as pests. This effort is an attempt to capture their roles as disturbance agents, agents of change in the landscape. The model operates on each pixel (1 X 1 km) in the assessment area and projects changes in cover type and structural stage using a set of successional pathway diagrams and transition rules. Several examples were given to illustrate the general approach being developed.

Roger Sandquist described the general activity occurring in the Terrestrial Team with examples from the invertebrates. The terrestrial team is analyzing rangeland issues, plants, vertebrates and invertebrates. The organismal analyses are done on a species by species basis with two major exceptions. Among the vascular plants only the C1 and C2 species (those proposed for listing as endangered or threatened species under the Endangered Species Act) are being considered in any detail. The invertebrates are considered as functional groups. Those groups chosen to be considered are described as 1) Detritivory and Nutrient Cycling (woody debris and soils are the principle media), 2) Predation (parasites and predators), 3) Pollination (bees only), 4) Rangeland herbivory (grasshoppers only) and 5) Forest Herbivory. To support this assessment reports on various groups or taxa were prepared by contractors. In addition, panels of scientists were convened to determine the likely effects of management practices on the functional groups. These two types of information are synthesized into a summary report having three objectives. The report will serve an educational role indicating that many groups of invertebrates, previously not recognized as significant, play critical roles in important ecosystem processes. Secondly several issues relating to common management practices are discussed. Research and monitoring is discussed within the concepts of integration among scientific disciplines and adaptive management.

John Moser described an interesting and important relationship between western pine beetle and a phoretic mite (*Tarsonemus endophloeus*) that he and others discovered. Larvae of western pine beetle depend on a symbiotic nutritive fungus, which the female beetle carries in her mycangia as conidia. The phoretic mite has been found to carry the ascospores of the fungi in sporothecae. These two fungal structures are necessary for

sexual propagation of *Ceratocystis ranunculosis*. It is postulated that without this phoretic mite the western pine beetle may not be able to survive. .

Workshop Summary: Insects in the Urban-Forest Interface

Moderator: David Leatherman, Colorado State Forest Service

Participants: 15

INTRODUCTION/DEFINITIONS

While difficult to precisely define, as used in modern forestry jargon the "interface" generally refers to the ecotone between urbanized areas and naturally occurring habitats (forests or prairies, for example). The characteristics of such edges make for unique phytophagous insect situations, both from biological and sociological perspectives.

Our workshop attempted to discuss some of these situations, around a framework of slides presented by the moderator.

VALUE SYSTEMS

The goals and objectives of landowners living in the interface are often not the same as those living in cities or visiting the forest, or the public at large. This can drastically change the way they view insects associated with trees. Also, the owners of trees on valuable properties often have intolerant attitudes towards insects. They are often financially well-off and well-educated but may not have a high degree of environmental concern or awareness. This "profile" has been quantified by the International Society of Arboriculture in their surveys to develop the "Plant Health Care" concept. As entomologists asked to provide input in various situations, it is paramount we recognize and consider all points of view. Often widely disparate views exist on opposite sides of arbitrary political boundaries. Biology is often (usually?) not the over-riding factor. It can be a goal of entomologists to increase the influence of biology on decisions.

FIRE-INSECT ISSUES IN THE INTERFACE

The typical western North American "interface" existing between true urban areas (houses landscaped by mostly ornamental plantings) or "residential forest" areas (a native forest infused with houses) and native forests is laden with fire issues.

The values at stake in urban or residential forest areas usually dictate that wildfires be suppressed. They also have an impact on the applicability or acceptance of prescribed fire. The risks of having a prescribed fire escape, and the associated air quality concerns, are often judged as too great when weighed against the perceived benefits. However, prescribed fires recently have been successfully executed within forested subdivisions in both South Dakota and Colorado (and probably elsewhere in the West). Insects typically associated with individual trees damaged by prescribed fire include red turpentine beetle (Dendroctonus valens) and engraver beetles (Ips spp.).

Long term altering of natural fire regimes often leads to changes in insect activity. These changes can be in terms of presence/absence, intensity, duration and interval between high population periods. Bark beetles such as mountain pine beetle (Dendroctonus ponderosae) are thought to be among the more important insects in this regard.

Colorado is experiencing its first large-scale native forest outbreak of Douglas-fir tussock moth (Orgyia pseudotsugata). It is thought that fire suppression, subsequent type conversion from ponderosa pine to Douglas-fir, and the recent absence of western spruce budworm (Choristoneura occidentalis) are all involved in the current upsurge.

COMPLEXITY OF INTERFACE ISSUES

This tussock moth area near Deckers (25 miles southwest of Denver) is characterized by many interface issues. Private land intermingles Pike National Forest land. Threatened and endangered wildlife species (the Pawnee montane skipper [Pamphila pawnee montana] and possibly Mexican spotted owl) exist in the area and affect potential moth treatment options. A stretch of the South Platte River designated as "Gold Medal Trout Water" runs through the infestation area. The USFS is being instructed to manage their lands under the guiding principles of "ecosystem management". The area is a major recreation district, located between the metropolitan areas of Denver and Colorado Springs. It harbors numerous campgrounds and over 150 miles of off-road motorcycle trails. The nearby urban areas are among the most heavily regulated air quality zones in the state.

An environmental analysis of such a situation not only demands that the immediate tussock moth situation be carefully evaluated, but that steps be taken to consider the impacts of a "no action" decision. For example, if the tussock moth is allowed to run its course and particular drainages sustain tree mortality, what are the attendant hazard considerations (dead trees falling and wildfire fuel buildups)? On one particular parcel of private land dead trees may be viewed very negatively. However, on a landscape scale the tussock moth-caused conversion to more open forest or one with a greater component of pine or one with better habitat for skipper nectar and food plants may be viewed quite positively.

DEAD TREE ISSUES

This leads to a discussion of dead trees, which generate much interest in the interface. Insects, directly or indirectly, often create dead trees. Whether such trees are then viewed as insect reservoirs, "wildlife" trees, firewood or hazards depends on one's point of view. Foresters, including forest entomologists, have an important role to play in educating the public about the biological diversity implications of having dead trees in the forest, evaluating the potential influences of dead tree fauna on living trees, and objectively measuring the physical hazards imposed by dead trees.

NATIVES VS. EXOTICS

Certainly the "interface" is a common site of conflicts between native and exotic organisms. This can take various forms. Insects and plants native to the forest are often imported into urban areas. Exotic plants can be planted in urban, residential forest or native forest areas. Such plants often harbor insects and can lead to their introduction into new surroundings. Gypsy moth (Lymantria dispar) is perhaps the classic example of this. Exotic plants are also, in turn, exposed to insects present on plants existent at the planting site.

Riparian forests in the Southwest are being impacted by both Russian olive and salt-cedar (tamarisk). These exotics, often planted as ornamentals or as part of conservation plantings

(windbreaks, wildlife plots, etc.), are escaping to riparian areas. Bird dispersal of seeds is a common mechanism of introduction. The displacement of native willows and cottonwoods by these aggressive species is generally regarded as detrimental to wildlife populations. One reason exotic-dominated riparian corridors are thought to support a less diverse bird fauna is that they do not support insect populations as diverse and/or as large as those of native tree species.

BRINGING THE FOREST TO THE CITY

Growing conditions present in urban sites often exacerbate problems from imported insects. A Colorado example would be pinyon pitchmass borers (Dioryctria spp. including ponderosae), which can cause more significant problems to pinyons growing within bluegrass lawn irrigation regimes. The striped pine scale (Toumeyella pini) on off-site ornamental lodgepole and ornamental Scots pines is an example of a combination where both the insect and its hosts are exotic. The poplar twiggall fly (Hexomyza schineri) is a native aspen gall-maker which is much more common in Colorado's urban environments now than 10-15 years ago. Its impact on urban trees is probably similar to that in native forests, but homeowners suffering from "perfect plant syndrome" have made it the #1 phone call insect along the Front Range. This has created a need for special educational efforts. Other forest insects being imported on transplant stock include pinyon tip moth (Dioryctria albovitella), pinyon pitch-nodule moth (Retinia arizonensis), twig beetles (Pityophthorus spp. and Pityogenes spp.), and engraver beetles (Ips spp.). The spruce engraver (I. pilifrons) has killed large numbers of Colorado blue spruce within the Denver metro area. The source of beetles is not known.

Urban plantings near the forest often attract wildlife. Deer are one of the more common conflict animals in such situations. Predators of deer, such as mountain lions, follow their prey into the interface and complicate the issue. Other problem mammals include porcupines and beaver.

BRINGING THE CITY TO THE FOREST

Development of native forests for subdivisions and ski areas has led to increased concern about a number of insects. Included in this group would be insects like fir engraver (Scolytus ventralis), balsam bark beetle (Dryocoetes confusus), poplar borer (Saperda calcarata) and pine butterfly (Neophasia menapia). The need for improved preventive methodologies was discussed, including repellant semiochemicals, preventive insecticides and silvicultural schemes. (See summary of "The Role Of Insect & Diseases In Subalpine Fir Decline" Workshop, moderated by Ladd Livingston for a further discussion of ski area management and fir insects).

MISCELLANEOUS ISSUES

Residential forests in the Pacific Northwest are now being increasingly viewed as sources of large, valuable trees by loggers. At times insect and disease issues are used by these wood procurers as incentives for owners to sell the trees. Examples were discussed where no money was received by the tree owners. They were simply told they should be happy to be rid of the hazard and insect problems present in the trees.

Also, the move toward "ecosystem management", by whatever definition used for this more holistic approach to forestry, will be difficult in interface areas. As forested land becomes fragmented, consensus among its many new owners may not be possible. Compromise would seem to be a necessary prerequisite to any action, including no action.

SUMMARY

The challenges of insects in the interface still existed at the end of our workshop.

Westwide pine beetle model

Eric L. Smith and Lance David

Eric Smith, from the Methods Application Group (MAG) and Lance David, Management Assistance Corporation of America, presented a session in which they gave an overview and update on the Westwide Pine Beetle Model. This model is designed to be used with the Forest Service's Forest Vegetation Simulator (FVS), to project the potential impacts of pine bark beetle on forests. The model is generic, so that different beetles can be represented by using different functions and coefficients. The beetles being modeled are mountain pine beetle, western pine beetle, and *Ips sp.* for which western pines are hosts.

This project began as a Forest Pest Management Technology Development Project, led by Dawn Hansen of the Intermountain Region. A steering committee of entomologists from each Region, and research entomologists, mensurationists, and modelers from Forest Service Research, have directed the effort and reviewed the draft versions of the model. The overall scope of the model, and the technical details of the model's functions, were determined through a series of workshops involving a large group of field, research, and academic entomologists, and others. Active participants in the process have included Jill Wilson, Kathy Sheehan, Dawn Hansen, Ken Gibson, John Schmid, Dale Bartos, Dennis Hart, and David Wood, among others. ESSA Technologies, Ltd. was contracted to do the computer coding for the draft version of the model.

In order to capture the population dynamics of bark beetle outbreaks, the model uses multi-stand forest areas, potentially hundreds of stands covering thousands of acres. This is different from existing FVS-based insect and pathogen impact models, which only operate on a single stand. Tree mortality is modeled on an annual basis, determined by the amount of beetle-caused tree mortality the previous year, and current stand conditions. Stand conditions can be modified using stand management treatments, such as thinning, available in the basic FVS model. Additional treatments, such as sanitation harvests, are modeled within the beetle model.

The current computer code will be extensively tested and debugged by MAG before the model is released for general use.

Workshop Summary: Systematics Workshop

Moderator: Tom Eager

Participants:

Mel McKnight	Laura Merrill
Bob Averill	Mal Furniss
Jim Vandygriff	Rich Dorsett
John Moser	Tom Eager, Recorder

This session was conducted as a round table discussion. Specific topics were brought up by interested persons and discussed by the entire group.

The first item was a presentation by Jim Vandygriff who demonstrated a simple diagnostic technique which enables an observer to distinguish between *Ips* and *Dendroctonus* larvae which have been dissected from infested trees. Although gallery patterns of these two bark beetle genera are quite distinct, when galleries overlap it is necessary to use morphological characteristics to separate the individual larvae. One characteristic which differs between the two genera is the shape of the post-mentum sclerite. A more reliable method is the pattern of setate found on the abdomen. This pattern appears triangular in Dendroctonus larvae while the pattern appears as a straight line in Ips larvae.

Mel McKnight gave a very valuable synopsis of the status of the Hopkins Systematic Identification System. This is a system of maintaining records on insect specimens which evolved from A.D. Hopkin's work. The basis of the system is the assignment of a reference number to a specimen which is cross referenced by field notes. The system allows entomologists to share information as well as augment insect labels.

In the mid 1980's, Mel began the effort to standardize and transform the system to a computer accessible format. All of the hard copies of the records (for the most part 3 x 5 inch cards) as well as field notes were called into Washington D.C. This information comprised 150,000 file cards in addition to 10,000 pages of field notes, all of which were transferred to computer. The system now contains 60,000 records which covers all accessions until the year 1986. However, there is no "manual" for accessing this information. Bob Bridges (Forest Insect and Disease Research, USDA Forest Service, Washington Office) is currently maintaining these records but it is unclear who will eventually take over maintenance of this information. Very little attention has been paid to these extremely valuable data and there is a danger of losing this information if it is neglected. The existence of this data base needs to be promoted, perhaps by an article in American Entomologist or via the InterNet.

Mel's presentation led to a general discussion that was quite sobering to all present. A number of examples were given in which some extremely valuable data, specimens, reports and information was simply discarded by an unknowledgeable person in the interest of "getting rid of some old junk". It would appear that we are currently at a

critical juncture since there is such a strong push to take old records and "put them on a computer". Digitization is an admirable goal, but extreme care must be taken not to lose important aspects of the information. The sentiment in the session was that all entomologists need to be made aware of this crisis and that some strong resolutions be made to save this irreplaceable information.

Mal Funiss gave a particularly striking example of the need to couple biological information with taxonomic work. He cited the case of *Scolytus monicolae* which had been synonymized with *S. tsugae* based strictly upon morphological characteristics. When Mal supplied specimens from both hemlock and Douglas-fir, the species was split into its present designation. Another example was the adult bark beetle parasite *Carpinskiella paratibiallis* which was separated from *Tomicobia tibiallis* as a result of a new host record. Mal stressed that workers in the field need to work together with taxonomists in order to supply them with critical information.

John Moser then gave a short synopsis of his recent work dealing with the relationship between bark beetles, associated mites, associated fungi and host trees. It is becoming apparent that the relationships between these organisms are extremely complex, recent studies indicate that some of the current concepts regarding the interactions of various organisms are incorrect. A number of fungi which were formerly thought to be transported to trees under attack by bark beetles have now been shown to be carried by associated mites. It will take some time to investigate all of the relationships; virtually all forms of symbiosis including mutualism, commensalism and amensalism appear to be present in these relationships. These new findings point out the intricate nature of bark beetle ecology.

Workshop Summary: Decline of Subalpine fir throughout western North America

Moderator: Ladd Livingston, Idaho Department of Lands, Coeur d'Alene, Idaho.

Tom Eager
Region 2 Forest Health Management
SUBALPINE FIR MORTALITY AT ASPEN MOUNTAIN SKI AREA

Increasing mortality of subalpine fir at Aspen Mountain Ski Area, Colorado, was a concern for ski area managers as well as the numerous visitors to the ski area. Since opening in the early 60's there has been almost no management in the buffer strips between ski runs. These buffer stands have evolved into even-age, highly stocked stands of mature subalpine fir many of which have been killed by Armillaria root disease and the western balsam bark beetle. The patterns of mortality indicate that *Dryocoetes* may build up its numbers in highly stressed trees and then spill out into the healthy adjacent trees.

There appears to be two causal agents of this mortality, Armillaria root disease and the western balsam bark beetle. The patterns of mortality indicate that *Dryocoetes* may build up its numbers in highly stressed trees and then spill out into the adjacent trees, attacking generally healthy trees.

A Vegetation Management Plan is being prepared by the ski area management. Recommendations include: 1) Remove all root disease infested trees, plus all trees within a 30-foot buffer. 2) Emphasized the concept of "dynamic leave strips" wherein ski runs will change and evolve over time. Areas will need to be fenced off so that regeneration can be established. 3) Encourage the establishment of tree species more resistant to root disease. 4) The situation at Aspen Mountain is an opportunity to educate the public about the dynamic nature of forest ecosystems.

The work being done at Aspen Mountain has alerted other ski area managers about the need to consider forest health in recreational areas. The highly visible nature of this work is an excellent opportunity to show recreational forest users the value of forest health management.

Peter Hall
FACTORS OF *ABIES* DECLINE IN BRITISH COLUMBIA

Our most common species of *Abies* is subalpine fir, *Abies lasiocarpa*. Extensive stands exist throughout British Columbia at higher elevations. Many stands are affected by a variety of damaging forest insects causing growth loss, top kill, and/or mortality. The 1994 aerial survey found that major damaging forest insects include balsam bark beetle, *Dryocoetes confusus*, balsam woolly adelgid, *Adelges piceae*, and two year cycle budworm, *Choristoneura biennis*.

Balsam bark beetle is a chronic mortality causing agent throughout central British Columbia. In 1994, surveys showed that beetle caused mortality existed on approximately 182,990 ha. Mortality occurred in patches. This level of mortality remains more or less constant from year to year killing up to 5% of the trees in affected stands. Currently, aside from sanitation and salvage harvesting, there are no management plans in place to reduce beetle caused damage. Research is being conducted on semio-chemical based strategies.

The balsam woolly adelgid was introduced into British Columbia in the mid-1950s. It initially caused extensive mortality and top-kill to various species of *Abies* on southern Vancouver Island and the lower mainland. As a result, a quarantine zone preventing movement of *Abies* materials was established to restrict the movement of the adelgid into the interior of the province. The quarantine zone appears to have been successful in slowing the spread of the insect; however, recent surveys have found adelgid infestations outside of the quarantine zone, likely due to natural spread.

Two year cycle budworm is also a chronic insect pest in balsam stands in the interior of the province. The year 1994 was an "off" year for defoliation as larvae were in younger instars. In 1995, when later instars are actively feeding, extensive defoliation is expected in several areas of the province. No treatment programs have been prescribed as damage is usually limited to increment loss in every second year. Little or no mortality caused by budworm feeding has been noted.

Ken Gibson

WESTERN BALSAM BARK BEETLE (WBBB) TRAPPING
USDA FOREST SERVICE, NORTHERN REGION, 1993-1994

In 1993 and 1994, we installed a series of Lindgren funnel traps baited with standard lures to assess WBBB *(Dryocoetes confusus* Swaine) flight periodicity in northern Idaho and western Montana. Traps were placed near beetle-infested subalpine fir stands, and installed about June 1 and retrieved about October 1. Trap collections were made weekly. Results were informative, but because 1993 was an abnormally cool and wet year, we decided to repeat the survey in 1994. We again caught numerous beetles, but not as many as in 1993. We are monitoring flights again in 1995, at approximately the same sites. Trap collections at each site were as follows:

MONTANA, 1993: First beetles caught June 22. A small "peak" occurred on June 29 with 102 beetles caught (ten-trap total). Populations declined from that date, but increased during mid-July and peaked again on August 4 (1700 beetles). Catches declined from that point to less than 200 when traps were taken down at the end of August.

IDAHO, 1993: First beetles caught June 4. A "peak" occurred on June 23 when 1,880 beetles were caught. Numbers declined until July 15, and rose to another peak on

July 29 when 1,747 beetles were found in traps. Numbers generally declined until traps were pulled on September 30.

MONTANA, 1994: First beetles found on June 6. A peak catch occurred on June 29 with 744 beetles trapped. Populations declined until July 22, and other peak occurred on July 28 (397 beetles). Populations declined from that point until traps were retrieved at the end of September. No beetles were caught after September 9.

IDAHO, 1994: First beetles caught June 17. Peak flight occurred on July 1, with 1,053 beetles trapped. Populations generally declined after that, and the last beetles were found on September 23. Traps were taken down October 7.

SUBALPINE FIR IN REGION 4, WHAT'S GOING ON?

JOHN ANHOLD, FOREST PEST MANAGEMENT, OGDEN, UTAH

A review of the aerial sketch mapping of subalpine fir (SF) mortality from western balsam bark beetle (WBBB) in Region 4 since 1987 shows a dramatic increase up to the present. To compare this level of mortality to other bark beetle outbreaks, except mountain pine beetle, it becomes apparent that this bark beetle also has the potential to cause substantial impacts on commercial, aesthetic and ecological values. Subalpine fir mortality climbed from 5,000 trees reported in 1987 to almost 350,000 in 1993. This increase is being attributed to the west wide drought that started in 1986.

Work that is being done in R-4 related to SF mortality:

1. Western Balsam Bark Beetle Flight Periodicity in Northern Utah. The flight periodicity of WBBB was studied during the summer months of 1992, 1993, and 1994. The contents of baited funnel traps were tallied up to three times weekly to determine species and average beetles captured per day. Two main peaks of flight activity were observed each year. The first and generally largest occurred in June soon after flight was initiated for the season. A second, typically smaller, peak was observed in August. The first peak had slightly more males than females while the second peak had a majority of females. Except during periods of cool or wet weather, WBBB were found to be active at least at minimal levels from June through September.

2. Endo-brevicomin as an Antiaggregation Semiochemical for WBBB. In 1993 WBBB trap catches, using baits containing a semiochemical mixture of exo-brevicomin, were compared with a combination antiaggregation pheromone, endo-brevicomin, and a bait. The bait only traps caught 22,000 WBBB while the bait with endo-brevicomin traps captured 6,000 beetles. All plots had fewer captures in endo-brevicomin traps, but there was considerable variation in the amount of reduction. The following year two application rates of endo-brevicomin were tested to determine if beetle attacks could be reduced. This data is yet to be analyzed.

3.In 1990 Douglas-fir tussock moth (DFTM) defoliation was detected on the Wasatch-Cache NF. This is the first documented tussock moth outbreak in Utah. Ground surveys revealed that SAF was heavily defoliated during the outbreak. Douglas-fir, though a minor component in the affected areas, had noticeably less defoliation and mortality. Adjacent stands of Douglas-fir had little or no visible tussock moth activity. Defoliation on SAF was typically found evenly distributed throughout the crown, rather than concentrated at the top. Ninety-four percent of SF with defoliation rating of 90 percent or more was killed. Top-kill occurred on nearly one-half of SAF's defoliated 25 to 89 percent. Heavily defoliated trees tended to occur in pockets bounded by areas of light defoliation. After three consecutive years of defoliation, tussock moth populations collapsed.

BALSAM WOOLLY ADELGID IN NORTHERN IDAHO

David Beckman and Ladd Livingston
Idaho Department of Lands

The balsam woolly adelgid was discovered in Idaho in 1983 attacking ornamental subalpine fir in Coeur d'Alene, and subalpine and grand fir east of Moscow. Ground surveys in later years found it to be wide spread in cool-air drainage bottoms of the same general area, attacking primarily subalpine fir. An 8 - 9 year study of subalpine fir infested with balsam woolly adelgid has been conducted. Plots were established in light, medium and heavy population areas. At the end of eight years, 36% of trees lightly infested at the beginning of the study had been killed. At the end of nine years, 87% of trees moderately to heavily infested at the beginning of the study had been killed. The subalpine fir in these study areas were found in low elevation, frost-pocket, drainage bottoms. The high number of trees killed in the moderate to high adelgid population areas has caused a significant change in the local cover type.

Panel Presentation: Bark-Beetle Depredations in the Black Hills Forest Reserve ca 1897-1907: Hopkins begins our legacy[3]

Malcolm M. Furniss

In 1897, Special Forestry Expert Henry S. Graves was handed the daunting assignment of measuring and describing the stands of forest trees on the 60,000 sq. mi. brand new Black Hills Forest Reserve. Along the way, he noted patches of dying pines on the high limestone divide in the North Hills and found an unknown bark beetle in all of them.

Andrew D. Hopkins, a man who rose from farming to become W. Va. State Entomologist in 1890 and who became an expert on *Dendroctonus* beetles, accompanied Gifford Pinchot to the Black Hills in Oct. 1901 to look into the cause of the "depredations". In consequence, Hopkins named the beetle *Dendroctonus ponderosa* (sic) in USDA Bur. Ent. Bull. 32 (1902). The type locality is Piedmont, S.D. Today it is known as the mountain pine beetle and it occurs in many pine species over a large geographic area.

Hopkins became head of the newly created Division of Forest Insect Investigations in 1902. In May 1902, Jesse L. Webb, who graduated from Washington State College in 1900, and studied forest entomology under Hopkins at W. Va. U. (MS 1902), was hired by Pinchot as Assistant Forest Expert and stationed at Elmore, S.D. under direction of Hopkins. Thus, Webb became the first American graduate in forest entomology. That summer, he studied the beetle's seasonal history, predators and other associated insects, and experimented with trap trees for control.

Trap trees were ineffective, so Hopkins advocated destroying the beetles by cutting infested trees and shipping the logs to mills at non-forested locations, or peeling bark from infested trees in the woods. However, until 1906, sale of green trees was prohibited, including infested trees that were not yet faded. Thus, control action rested solely on peeling infested bark.

Hopkins' "Black Hills file" shows that other people also had ideas about controlling the beetle. Mr. Tinsley of Custer, S.D. developed a cutting tool with removable handles for stripping bark up to a height of 25 ft. on standing trees. And Mr. Yarbray, also of Custer, wanted $50 cash, a lineman's outfit, 20 miles of insulated No. 12 copper wire, a safety belt and saddle horse. With them, he promised to rid the Hills of the beetle. Hopkins noted: "It would appear that he contemplates electrocuting the beetles individually or collectively....It is too bad we have to turn down such advanced ideas." Still others went about transplanting "slime" that they believed was killing beetles (Deadwood, S.D. news clipping).

Whatever perils brought about the beetles' demise, the outbreak, which had killed one billion bd. ft. of pine, waned after 1906 and Hopkins set about finding evidence that his

[3] Subseqently published as: Furniss, M.M. 1997. American forest entomology comes on stage: bark beetle depredations in the Black Hills Forest Preserve, 1897-1907. American Entomologist 43: 40-47.

recommendations were responsible. His final word on the matter was to Forest Assistant John Murdock, Dec. 20, 1910, that all evidence now indicated that there must have been 10,000 to 15,000 infested trees cut and peeled during 1906-1908 and "If so, there is no doubt in my mind that this was the primary cause of ending the trouble." And, "There is no trace of doubt in my mind that if my recommendation in 1901 and 1902 had been promptly adopted and carried out, there would have been no further loss of timber from the work of the beetles....The Forest Service should certainly profit by this expensive experience."

So ended the last involvement of the principals who had come to the Reserve at the beginning of the decade to look into the mysterious "pine-destroying beetle." Pinchot, himself, would be fired in 1910 over differences with the Department of the Interior, and he succeeded as Chief Forester by Henry Graves. Webb transferred to a different Division in the Bureau of Entomology in 1912. Hopkins continued in charge of Forest Insect Investigations until 1922. Under his influence, forest entomology had grown into a strong discipline, continuing to this day.

Panel Presentation: Using Historical Records in Ecosystem Management

by
Sandra Kegley

Ecosystem management can be described as a different way of looking at forest management. Instead of looking at stands, we are now looking at whole drainages and landscapes. Instead of looking at insects and pathogens as "pests" or something negative, we are looking at the functions they perform in ecosystems. We are also determining if and how that function or insect and pathogen abundance has changed over time.

Insects and pathogens are primary disturbance agents in most natural forests. In fact, they recycle far more biomass in the course of stand development than is typically consumed in fires. Some actions by these agents can produce dramatic affects such as large bark beetle or defoliator outbreaks. Others are less dramatic, such as root diseases, but equally important because they are largely drivers of natural forest succession.

Of the many functions insects and pathogens perform, one of the most important is how they influence succession. I'll use mountain pine beetle (MPB) in western white pine as an example of how an insect might affect succession. In mixed species stands where western white pine is a seral species, the action of MPB removing mature white pine would allow space for shade tolerant species to grow resulting in an acceleration of the stand towards a climax condition. An indirect successional function would be to increase the fuel loading and chance of a stand replacing fire, which would reset succession by creating an opportunity for seral species to regenerate.

To ensure that the affects of insects and pathogens are considered in landscape level analyses (many of which use successional modeling), a team of entomologists and pathologists in the Northern Region has been working on a "broadscale analysis". We are looking at the major insects and diseases and identifying and characterizing important successional functions of forest insects and pathogens. To do this, we will:

1) describe how insects and pathogens affect spatial and temporal patterns of succession,
2) describe current and historic insect and pathogen regimes,
3) and predict future successional trends, which reflect the role of insects and pathogens.

To describe historic insect and pathogen regimes, our objective is to determine how insect and pathogen disturbances have changed in scope and frequency with changes in vegetation over time. Some of the tools we used in describing historic insect and pathogen regimes include old aerial photos and historic vegetation maps to describe historic vegetation in areas where we had current inventory information available. Historic maps and photos gave us cover type, size class, density, age, and composition of forests. We could then compare current vegetation to historic vegetation on the same piece of ground.

We used current hazard rating, susceptibility indexes, and risk rating systems to determine hazard of historic vegetation to insects and pathogens and compared it to current hazards on the same piece of ground. We obtained a partial history of insect activity from information from aerial surveys. However, aerial surveys in the Northern Region began in 1948 and continuous coverage of the region did not occur every year.

That's when we turned to historic reports and luckily we still had some of these around. One of my tasks was to characterize MPB in western white pine. But white pine forests today are not at all like they were at the turn of the century. Historically in northern Idaho, western white pine cover type covered 60% of forested land. On the same ground today, white pine covers only 16% of forested land. Age and size classes have also changed. In the 1930's, white pine blister rust was discovered in Idaho. A combination of logging the valuable white pine, blister rust killing all ages of white pine, and MPB outbreaks killing mature trees has drastically reduced the white pine component of forests today. Much of the white pine forest has been replaced by Douglas-fir and true firs.

We still have some mature white pine and MPB kills some every year. From aerial survey data over the past 32 years, an average of 350 white pine trees are killed by MPB each year on the Idaho Panhandle National Forest.

A picture of what a historic white pine forest looked like is shown in fig. 1. From historic reports dated 1928-1936, an average of 15,500 white pine trees were killed by MPB per year on the Coeur d'Alene National Forest (currently part of the Idaho Panhandle National Forest). That is quite different from the current 350 trees killed annually. It is only from historic reports that we find that MPB has had a major influence on western white pine. MPB could become as destructive again as resistance to blister rust improves and white pine becomes a dominant component of forests once again.

Also from historic reports, I found information from a study conducted in 1940-41 (Terrill 1962) to determine the susceptibility of western white pine stands to MPB attack. Mortality by MPB was related to age class, basal area, and percent white pine in a stand. We have no such information from current studies. I've used this information to identify white pine stands that would be of high hazard to MPB in historic and current forest types.

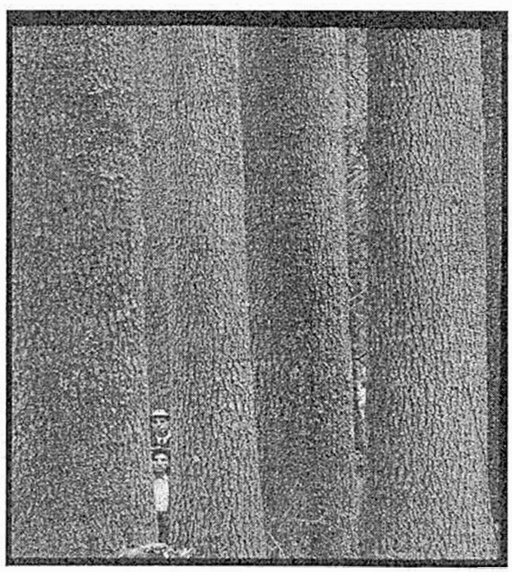

Figure 1. Historic western white pine forest susceptible to MPB.

Here are some excerpts from a report by James C. Evenden dated Oct. 6, 1924 about an experimental control project for MPB in western white pine in the Independence Creek drainage on the headwaters of the Coeur d'Alene river.

He says: "Camp was established at the Elk Horn Cabin it being possible to work the entire area from this location. The crew consisted of four laborers, a cook, Ranger Mooney, and the writer. The method of treatment consisted in felling and peeling the bark from the infested portion of the trunk (fig.2). Axes were used for peeling and though a short handled, straight bladed spud would greatly expedite this work, it would not supplant the axes. The trees were not bucked except when necessary to roll the trunk in order to peel the underside. Most of the trees were very heavily infested, it being not uncommon to find from 200-300 larvae per square foot of bark. These heavily infested trees, many of them being infested to a 6-inch top, peeled very easily it being possible to knock off great flakes of bark several square feet in area from the lower portion of the trunk. The lightly infested trees peeled very hard and it was often necessary to chop the bark from the trunk."

That sounds like a pretty tough project! The wages were as follows: cook $90 per month; laborers $0.50 per hour. Subsistence was 147 meals @ $0.35 each. Cost of treatment was $7.49 per tree. Evenden states that they could have reduced the cost per tree to $6.61 if they reduced the "noneffective time (travel time) of the crew".

This was only an experimental project. From 1929 to the early 1950's, they treated thousands of infested western white pine trees each year, costing hundreds of thousands of dollars. Those involved felt that tree mortality would have been much worse had they not been treating infested trees. Peeling the bark was the treatment until about 1935 when they switched to burning and applying chemicals. It was not until about 1950 that they started talking about indirect control by removing susceptible trees.

I have learned that historic records as well as "historic" or more mature entomologists are extremely valuable and provide us with insights we might not obtain elsewhere.

Fig. 2. Peeling western white pine for MPB control in the 1920's.

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Panel Presentation: WFIWC History Committee: Objectives, Progress and Plans

Boyd Wickman

The Western Forest Insect Work Conference Chair appointed Ron Stark chairman of a newly formed history committee in 1984. He deserves much credit for promoting the committee and increasing the awareness of our organization's rich history and the important contributions of past members. Malcolm Furniss became co-chair in 1988 and I became a co-chair 3 years ago. The committee is composed of the membership -- all of you are welcome to participate. Some of you have already contributed in various ways to committee history projects as evidenced by Sandy Kegley's presentation on this panel.

The history committee's prime objective is to keep the membership aware and informed of forest entomology history projects through our annual report. We are also working on preserving, cataloging and finding archival resources for photographs, reports, and other written material and artifacts of notable entomologists. Mal and I, are also researching and preparing historical reports on western forest entomology for publication. We would like to encourage others who may have a similar vent.

Progress has been steady and I think noteworthy, considering this is an unfunded and volunteer effort. Last August Mal and I met for 2 days at Moscow, Idaho. Mal introduced me to the University of Idaho library historical archives. A section has been designated specifically pertaining to western forest entomology. I was impressed with the quality of the facility and the ability to access and copy desired documents. It is obviously an excellent repository for much of our historical material.

During our meeting last summer we spent time discussing the old Bureau of Entomology forest insect photographic collections at the PSW Station in Berkeley and the PNW Station in LaGrande, both of which date from early in the century. We are both working on manuscripts that involve using photographs from these files and are concerned over their present storage, security and difficult access for potential users. Our first priority has been directed toward preserving this extremely valuable resource. The photograph files are probably the best in the U.S. on forest entomology. Mal has prepared a manuscript to be published in the U.S. Forest Service "History Line" newsletter describing the California photo file and I will follow with a similar article describing the file at LaGrande, Oregon. We hope through this publicity that those interested in forest history and Forest Service leaders will help us obtain some resources to properly catalog and maintain these photographs. Many are glass plate and nitrate based negatives that have special storage or copying requirements. The clock is ticking on whether many of these photographs survive to the next century. At this point I will show you some copy slides from a few photographs illustrating the breadth of subject matter and historic value. (slides)

As for future plans there seems to be no shortage of needed projects, but unfortunately there is a shortage of funds and help. Mal and I will continue our work on the photo files the coming year. We need to get the file indexes on a computer system. This will require

funding from some source. Additionally, we need to continue our survey and cataloging of other historical resources. The example of old photographs is obvious, but old reports, correspondence, and artifacts are also in need of locating, cataloging on a computer system and protecting at one or several locations. For instance, I do not know of any Canadian Government, State Government, or University involvement in locating and preserving forest entomology historic resources. No one from the membership has stepped forward and volunteered to play a leadership role for Canada and Universities.

The WFIWC history committee is made up of anyone interested in participating. The current co-chairs are guiding, documenting and planning committee projects, but we need your input. The previous speakers on this panel and in workshops gave some excellent examples of the value and use of historical records. There is no such thing as ecosystem management without historical reference to ranges of natural variability. Many disciplines in forestry are relying on best guesses to obtain the historic references, by contrast forest entomologists have some rich historic resources available. Our challenge now as a professional organization is to protect these resources for use by current entomologists and make certain that they will be available for future generations.

Panel: Forest Insect Research and Management in a Reinvented Forest Service

Moderator: Ann M. Bartuska, Director, Forest Health Protection

(1) FOREST HEALTH INITIATIVE

Ann M. Bartuska, Director Forest Health Protection, USDA Forest Service

This is a time of great change throughout the Federal government, and certainly within the Forest Service. Budgets are being reduced, there is clear lack of support for science by the Congress, and we are all being expected to downsize. However, within the forest health area, exciting things are happening. The fires of 1994 focused attention on forest health issues in the west, and led to the development of the Western Forest Health Initiative. The Initiative examined Forest Service programs and processes to determine if they facilitated taking action to achieve healthy forested ecosystems. Activities being implemented as a result of the WFHI include: (1) developing a nationwide forest health policy that links fire, insect and disease, weather effects, and forest management, (2) incorporating forest health into the FS budget and performance measures, (3) further moving to full implementation of the Forest Health Monitoring program, (4) funding a set of forest health projects through the state foresters, and (5) developing an annual report on the health of the nation's forests.

Consistent with this broader emphasis, the Forest Pest Management staff is being renamed FOREST HEALTH PROTECTION. More then just a name change, this reflects a commitment to resource issues beyond insect and disease control; we are increasingly providing technical assistance dealing with non-indigenous plants, and we are proactively integrating insect and disease activity with fire, climate, and stand structure--meeting our obligation as forest health professionals. At the same time, we are maintaining our commitment to a strong, professional workforce of entomologists and pathologists, and to development and use of new technologies in support of our programs.

(2) A NEW LOOK FOR RESEARCH

Bob Bridges, Forest Insect and Disease Research, USDA Forest Service

The FIDR program is undergoing changes in emphases, and these changes will no doubt continue, if not accelerate, in the future. In the future FIDR will continue to conduct research on developing pest management tools--much like we have done traditionally. However, a substantial amount of effort will be directed to research that address questions about forest health that go beyond just how to control or suppress pest outbreaks. Information about insects and disease organisms must be integrated into a larger context of disturbance ecology. We need more information about how insect and disease organisms interact with other disturbances such as fire, to shape ecosystems. We need to continue research on

the role that insects play in ecosystems--not just a pests but beneficial components of forests. Insects and microorganisms greatly dominate the biodiversity of forests. Surely we must understand the role these dominate organisms play if we are to understand how ecosystem function. FIDR will also continue to emphasis research on exotic species, which pose very significant threats to forest health and ecosystem integrity.

Organizationally, Forest Service Research is also changing. The Southern and Southeastern Forest Experiment Stations were recently merged to become the Southern Research Station. Intermountain and Rocky Mountain Stations plan to merge as soon as necessary approvals can be obtained. The Washington office has developed a reorganization plan and expects to reorganize the research staffs in the near future. Research staff will consolidate from six staffs to four. FIDR will merge with Forest Management Research and with other staff functions (such as fire ecology and forest operations) to form a new staff called Vegetation Management and Protection Research.

(3) MAKING TECHNOLOGY AVAILABLE
Bill White, Forest Health Technology Enterprise Team, USDA Forest Service

Forest Health Protection is maintaining a commitment to providing technology in support of our programs, the challenge is how this can be done in a reinvented, reorganized Forest Service. To meet this challenge, FHP has formed the Forest Health Technology Enterprise Team (FHTET), bringing together the Pesticide Application Technology Group (Davis, CA), the Methods Application Group (Ft. Collins, CO), and the national Center of Forest Health Management (Morgantown, WV). The mission -- **to foster development and use of technologies to protect and preserve the health of America's forests.** This will be accomplished through the following program areas: (1) Information services, including enhanced access to the Internet, (2) Technical support services, (3) Training and education, (4) Technology development, including management of the TDP program, and (5) Methods improvements.

In order to more effectively transfer the new technology and other programmatic activities, the FHTET is committed to improving lines of communication to all user groups. The FHTET is equally committed to meeting our customer needs and revising our program of work to meet those changing needs.

(4) INCORPORATING DISTURBANCE ECOLOGY INTO MANAGEMENT
Bob Averill, Region 2, Forest Health Management, USDA Forest Service

There is an expectation by many people of a stable non-changing environment. While this is comforting to contemplate and wish for, and even reflected in law as a desired outcome, the reality of ecological processes are that change is constant. More often than not, changes induced upon the landscape by insects and diseases have been deemed undesirable by man. For many decades our collective wisdom

has been to subdue these events. However in recent times we have begun to rethink that old "control" paradigm as we have begun to understand ecological processes in a new light. Rather than the linear thinking that our control paradigm has brought, we see more clearly the true chaos that ecosystems have within them as they change from day to day and season to season, sometimes at rates that are alarming. As we begin to understand and to value these changes we appreciate the essential role of disturbance processes in ecosystem management and to understand that disturbance is essential to the maintenance of species and communities.

So the challenge becomes the need for better anticipation of change in the ecosystems and a more clear valuation from the human dimension perspective. Ecosystems change, merely because the process of life and death provides for change. These changes in time and space have no value to ecosystems- only reflect change. But, what has value is how we humans value and manage these changes to meet our collective social needs. The fact that a species invades another continent makes little difference except in the human dimension as species come and go over time inducing change. If we thought about it- maybe we could use disturbance processes to help manage ecosystems. If we thought about it - maybe our human induced management activities are disturbance processes that can facilitate allowing change at a rate that is acceptable to the human dimension in the intensity of change. For sure if we try to prevent disturbance processes from going forward, at some point there will be a large-scale disturbance event that really will be larger than anyone would want. Are not the conditions we see in the western forests somewhat a function of our past effort in pest management and fire suppression? Is this desirable?

(5) WILLINGNESS TO IDENTIFY FOREST HEALTH PROBLEMS

Joe Lewis, Forest Health Protection, USDA Forest Service

There may be several schools of thought concerning the appropriate way for providing technical/scientific information to managers/decision-makers. I'm interested in the following two:

1. The "Good Science" school of thought
2. The "Adaptive Management" school of thought

I'm using these labels for the sake of argument. I know they are commonly used in other contexts, but I often hear them used by people who espouse the philosophies I'm about to describe. I'm also limiting this discussion to the Entomology/Plant pathology disciplines. And I'm generalizing.

The Good Science school says that insects and diseases are normal components of ecosystems, and their relationship to forest health is complex and not fully understood. Much additional empirical data and scientific inquiry are needed before the entomology/pathology profession can make any recommendations on what constitutes a forest health problem and how managers might deal with it.

This school of thought can cite several instances where actions taken to ameliorate perceived pest problems did more harm than good. The general conclusion is that because scientific data is incomplete, it is inappropriate for entomologists/pathologists to identify "unhealthy" situations and propose potential "fixes". Doing so would not be good science.

The Adaptive Management school doesn't argue with the premises of the Good Science school, but it does take issue with the conclusion. There will never be enough insect/disease/forest health data to drastically reduce the uncertainties surrounding forest health issues. Expert judgment and experience, combined with limited empirical data, is sufficient (maybe essential) to describe what is healthy/unhealthy and to recommend approaches for addressing the effects of insects/diseases on forest health. Scientific inquiry will continue, and expert opinion will change over time as knowledge is enhanced. The general conclusion is that we should "go with what we know" and adjust as we get smarter. Not doing so would be bad management science.

If "knowing" something implies "with certainty", then I agree that entomologists/pathologists don't know much. Often, on that basis, their advice to managers is "we can't advise you until we get more scientifically sound information". Managers then decide to do something or do nothing without the benefit of insect/disease expertise.

I'd like to see more of an adaptive management attitude among entomologists/pathologists. They have a great deal of knowledge, albeit incomplete and uncertain, to offer to managers. Better that managers make decisions based on imperfect information about insects and diseases, rather than total ignorance.

Workshop Summary: Forest Insect Issues in Riparian Areas

Moderator: Jill L. Wilson

Approximately 20 people attended this informal and lively session concerning forest insect issues in riparian areas. Deanna Reyher, Soils Scientist and Ecologist, Black Hills National Forest, started off this workshop with an informative presentation discussing the importance, major issues, desired conditions and forest insects and diseases associated with riparian areas in the Black Hills of South Dakota and Wyoming.

Riparian areas represent the zone of the interaction between aquatic and terrestrial environments. They are extremely important in that they are biologically very productive and provide linkages between these ecosystems. Healthy riparian areas protect aquatic ecosystems through their influence on light, temperature, and water quality. They are also important to humans for recreation, drinking water, etc. Healthy riparian ecosystems possess stable streambanks, narrow, deep channels, overhanging vegetation, a mix of seral communities, natural meander patterns (for lower gradient streams), characteristic aquatic biota, aggredation and degradation equilibrium, vigorous riparian plant regeneration, and few exotic species.

The impacts to riparian areas in the Black Hills have been many, including mining, grazing, roads, removal of beavers, etc. As a result of these impacts, riparian vegetation will eventually be converted to more xeric plant species resulting in less diverse communities. Management issues are complicated by ownership patterns, half the area is under private ownership. Many riparian shrub communities have been converted to grass. Stresses on willows from the above impacts and decrease in shrub rejuvenation processes have weakened many *Cryptorhynchus* (*Sternochetus*) *lapathi*, which according to the literature is actually an introduced species from Europe. There has also been invasion by other exotic species. At the present time riparian ecosystems are still impacted by housing, recreation, grazing, logging, mining, and off road vehicles. Many laws, including the Clean Water Act and Endangered Species Act provide conflicting direction.

Desired future conditions for riparian ecosystems for the Black Hills include: increased extent of healthy conditions, reintroduction of beaver, restoration of fire, and restoration of upland conditions.

Insect and disease impacts are not well understood, however, many woody plant communities are stressed by senescence and degraded site conditions and are very susceptible to these agents. Activity of some forest insects, such as the mountain pine beetle, may actually benefit riparian ecosystems by reducing canopy cover in uplands.

Jed Dewey, Entomologist, Northern Region, discussed some work people in his region have been doing in riparian ecosystems. Gypsy moth trapping is concentrated in riparian areas, primarily because potential hosts are also concentrated in these areas. Starting in the 1980'sm the region entered into a cooperative project with the Montana Dept. of Fish

and Game to evaluate effects of spruce beetle and spruce beetle suppression measures on bull trout populations. Several key streams for spawning were located in the middle of a spruce beetle epidemic. Project planners were interested in the effects of the spruce beetle and the spruce beetle control project on bull trout habitat quality. Stands located within and outside the outbreak, as well as treated and untreated stands were examined. They found fewer negative effects on bull trout in the untreated areas compared to treated. There also were no differences in bull trout spawning stream quality between control areas within the epidemic and areas outside of the outbreak.

Ralph Thier, Entomologist, Intermountain Region (Boise Field Office), spoke about spruce beetle issues associated with a recent outbreak in south central Idaho. He prefaced his discussion by saying that there is one absolute truth in life: "all living things die!" Recently Idaho experienced a tremendous spruce beetle epidemic. In a number of areas sanitation salvage measures were applied, but buffer strips were left along riparian zones. Unfortunately later a fire started and this buffer strip, left to protect the riparian zone and the stream, was burned. This gave rise to some vigorous discussion among the participants.

John Anhold, Entomologist, Intermountain Region (Ogden Field Office), shared some riparian area improvement that their group has had. The first project he discussed involved aspen decline at the Rock Corral campground on Bureau of Land Management (BLM) land. The decline has a number of causes but among the immediate ones is oystershell scale. Many other factors are involved though, including impacts of the campground, and the age of the aspen (which is a relatively short-lived species), etc. The decision was made in this case to suppress the scale population with sevin. The stream was protected by tarping. This year they plan to revisit this area and take samples in order to evaluate effectiveness of the treatment. The second project John discussed involved an area on the Dixie National Forest, the Pine Valley Recreation area. This area has a mix of species including cottonwood and pine. Both have been impacted by scale, and bark beetles are affecting the pines. Both species have been impacted by heavy recreation use in the area. John said that they have recommended that the District develop a vegetation management plan for the area. John also briefly discussed the gypsy moth suppression project that occurred in the Salt Lake area along the Wasatch Front. Much of the project was aimed at protecting watersheds.

Jill Wilson, Entomologist, Southwestern Region (Arizona Zone) was the last presenter. She summarized this topic from a southwestern perspective. Riparian areas are critical in the arid Southwest. In Arizona alone, 80 percent of animals use riparian areas at some stage in their lives. Many sensitive, threatened, and endangered species reside in or depend upon riparian areas. It is estimated that 70 to 90 percent of natural riparian vegetation has been lost in the Southwest. In Arizona, 90 percent of the historic cottonwood, willow gallery forests have been lost. For example, at the turn of the century there were 400,000 – 450,000 acres of riparian forest along the Colorado River between Fort Mojave and Fort Yuma. By 1986, only 768 acres remained. There has been a loss of many permanent perennial streams. Many ephemeral and perennial stream channels have become "channelized" or downcut resulting in a lowering of the water

table and replacement of riparian communities with more xeric communities. The major issues affecting southwest riparian areas include: threatened and endangered species, grazing, flood control and power generation, and water rights/private property rights vs. ecological concerns. We have limited involvement in riparian issues and have had limited requests for assistance in this area. Since 1988, we've been involved in three riparian projects on Arizona willow, Arizona alder, and Thinleaf alder. Two of these projects involve forest pathogens, not insects, but may also be of interest to this group.

Arizona willow, *Salix arizonica*, a candidate for listing with the US Fish and Wildlife Service, is distributed along 15 drainages in the White Mountains of Arizona, but more recently was discovered in southern Utah. Populations in the White Mountains are small, and declining, while those in Utah are very large (each population containing more plants than found in Arizona) and appear much healthier. Declining status in Arizona has been tied to a number of factors both direct and indirect. Several herbivores including cattle, elk, insects, rodents, and a rust (*Melampsora* spp.) cause loss of plant tissues directly. In addition to these direct effects on plants, there are a number of indirect effects to habitat including soil compaction resulting from cattle and recreationists, stream bank instability, siltation and general degradation of riparian habitats that support this species. In addition, water diversion due to man and beavers have both desiccated and flooded plants, killing large numbers. These indirect factors have affected not only the adult willows but also contribute to loss of suitable habitat for seed germination and survival. Mary Lou Fairweather, Pathologist with our Arizona Zone office of Entomology and Pathology, became involved because of concerns over effects of the rust infection. Mary Lou is monitoring this situation, and feels that in some areas where the AZ willow populations are low and susceptibility to rust infection is high, that the plants are more prone to impacts by other environmental factors such as frost damage or water diversion.

Arizona alder, *Alnus oblongifolia*, grows between 5,000 and 7,500 feet along mountain streams in the Southwest. In 1994 we were asked to examine an area located along a several mile stretch of the Hassayampa River on the Prescott National Forest in western Arizona where these trees were experiencing defoliation and dieback. We found extensive defoliation caused by the alder flea beetle, *Altica ambiens*, at least two canker causing organisms, *Hypoxylon* and *Cytospora*, as well as extensive flood injuries. The area that was apparently most severely affected appeared also to be heavily impacted by placer mining, grazing, and recreation use. In this area there was extensive flood damage to the alders, and almost a complete absence of alder regeneration. We plan to monitor this situation including both affected and unaffected stretches of the river through some sort of permanent plot system.

Thinleaf alder, *Alnus tenuifolia*, grows in several mountain ranges in Arizona. It is found along streams between 7,000 and 9,500 feet. In 1989 we were asked to diagnose the cause of dieback occurring throughout the Alpine Ranger District on the Apache-Sitgreaves National Forest. We found extensive dieback associated with cankers caused by the fungus *Valsa ceratophora* (=*Cytospora umbrina*). This is an opportunistic fungus, which forms a diffuse canker that may completely girdle and kill the stem it infects. We

concluded that drought in combination with the fungus was largely responsible for the extensive dieback.

Most of the participants in the workshop were very interested in riparian issues; however, few of us had much involvement in this arena due to other priorities. It is however, a very important issue here in the arid West and one that merits more of our attention in the future.

Workshop Summary: Insects Associated with Non-Timber Resources Planning Considerations

Moderator: Iral Ragenovich, US Forest Service, Pacific Northwest Region

Participants: 8

The workshop was held in an open format. Participants were asked to identify themselves and discuss their experiences with insects associated with non-timber resources in one of two contexts; either:

1) the traditional role where the insect is a pest that is affecting some resource(s) other than timber, or

2) where insects are being considered as part of the ecosystem, or as an entity upon which another resource is dependant.

A variety of examples of the traditional role of insect as pest were discussed. These included:

Douglas-fir tussock moth (DFTM) outbreak in Colorado. This is the first time a DFTM outbreak has been recorded there. Previously the area was predominately ponderosa pine, and now it is primarily Douglas-fir with scattered large old growth pine. There is private land and small communities intermingled with National Forest lands. Excess fuel and wildfire potential are primary considerations. The area has unstable granitic soils so activities causing soil disturbance must be minimized. In addition, the area, because of it's proximity to Denver, has extremely high recreational use. Trails are heavily used by hikers, mountain bikes, and motorcycles. The South Platte is a premier blue ribbon fly-fishing river. The Pawnee montane skipper, a t&e species, occurs in the area and requires open meadow-like habitat. Management focus is not on suppressing the DFTM infestation, but in managing the area to reduce wildfire risk, return pine as a dominant species, protect recreational values, and enhance habitat for the Pawnee skipper.

Several examples were brought up with regard to impacts of insect outbreaks on water quality. Water quality concerns included such items as loss of shade on streams, increased water temperature, increased nitrates in streams, and so forth. These items were discussed in relation to a spruce beetle outbreak in British Columbia, a past DFTM outbreak in Oregon, and a Hemlock looper infestation in British Columbia.

The pandora moth on the Kaibab plateau was an example of how considerations can change or there can be conflicts between species of interest. Initially it was felt that defoliation of pines by the pandora moth would be detrimental to the Kaibab squirrel, which prefers denser, close canopies. However, the goshawk, which occurs in the same area, requires openings for hunting. Pandora moth defoliation, and subsequent occasional scattered tree mortality would be of benefit to the goshawk, but not to the Kaibab squirrel.

Examples of how insects were considered, when not in the traditional pest roles were:

The Columbia River Basin Analysis, which is evaluating various guilds of insects and their roles in the ecosystem. These included such insect guilds as wood boring insects, range insects, soil arthropods, and foliage harvesters.

A second example of the non-traditional role of insect considerations was the impact of a B.t. treatment for western spruce budworm on non-target lepidoptera which serve as a food source for a sensitive bat species, the Townsend big-earred bat. Lepidopteran species are the primary food source for the bat; females forage within a fairly short radius while nursing their young, therefore, consideration was given to the the impact of B.t. on lepidoptera other than western spruce budworm, and how that could ultimately impact available food source for the female bats. Primary areas where these non-target lepidoptera would occur are in the riparian areas.

Workshop Summary: Nontarget considerations for bio control

Moderator: Bill Schaupp (substituting for Dick Reardon)
Attendees: 16 people participated for all or part of the session

The session was opened by a description of current efforts by the US Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) to revise its biological control regulations and procedures. This would be the first such major revision in 20 years. A copy of the Federal Register (Vol. 60, No. 17; Jan 26, 1995) containing APHIS's proposed rules was circulated. Attendees were urged to provide comments to APHIS. Criticism was voiced over parts of the proposal, especially regarding an apparent failure to consult entomologists who are active biological control practitioners in the development of the proposal.

The discussion then covered various ideas regarding proper regulation. Particular attention was given the relatively unstructured situation with respect to entomophagous insect introduction for biological control in the United States. It was suggested that procedures should be adopted that are similar to those for the introduction of phytophagous insects against weeds. Delays caused by increased regulatory review are a concern, but there is a growing awareness of the potential and real nontarget impacts of biological control agents. The contrast between biological control of weeds using phytophagous insects and biological control of insect pests using entomophagous insects was a theme woven throughout the session.

Another theme threaded throughout the session was the action and impact of generalist entomophagous insects. Various positive and negative examples were shared. Many of the negative examples were from islands. Many of the positive examples concerned introductions that many thought would not be permitted currently.
Weed bio control projects in Hawaii have apparently been compromised by the generalists imported earlier against agricultural insect pests attacking recently introduced weed-feeding insects. These same generalists attack the native Hawaiian fauna, too. The current review process for proposed biological control introductions into Hawaii was described. It is all-inclusive regarding political input, in addition to having rigorous host testing. Unknowns and potential risks are described openly in this process. Similar protocols and procedures are followed in Australia. Risk management is becoming more a part of pest management.

The positive impact of generalist entomophages was also well described. While nontarget effects may occur, there are theoretical and well-documented empirical examples as to why generalists are important in natural enemy complexes and as biological control agents. Many expressed fear that biological control will be severely compromised as a tactic should all future introductions be strictly limited to specialist natural enemies with a very limited host range.

Brief discussions also covered the topics of deliberately using new host associations in biological control and of potentially negative impacts of altering native forest insects activity, such as mountain pine beetle, by employing new associations or overly effective biological controls. Dave Schultz presented an example of nontarget impact using pheromone traps in which generalist predators of Ips were killed along with the target bark beetle.

Airborne Videography for Forest Health Protection

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Airborne videography has emerging as another remote sensing tool for resource managers. Forest Pest Management has been developing and evaluating video image acquisition and analysis technology for use in resource applications. Combining a high□quality, Super□VHS video camera system with Global Positioning System (GPS) navigation, and image processing and analysis techniques, forest pest management specialists will be able to detect and monitor pest activities.

Videography offers many advantages over more traditional methods of pest detection and monitoring, including lower cost than ground methods, higher accuracy than conventional aircraft□based sketchmapping surveys, and faster turnaround time than conventional aerial photography methods. Although the video developmental efforts at the Methods Application Group (MAG) have been centered around pest management activities, it is apparent that this technology has a wider range of applications and uses for other resource management disciplines. Video shows potential for a variety of other resource interests including (only a partial list) post□fire evaluation (mapping burned areas), range management, recreation, riparian habitat, storm damage assessment, timber management, wetland mapping, and wildlife surveys.

The video system is designed to be installed in small aircraft such as those used for visual/sketchmapping survey flights. The airborne video image acquisition system developed by FPM/MAG consists of a variety of components that have been consolidated into one package. Many of these components are commercially available from various vendors, while a few components essential to linking the system have been developed by MAG. A total of 18 airborne video systems are now located throughout the U.S.

Once video imagery has been successfully captured on tape, it can be used immediately in management applications. This use can be as simple as viewing the video tape on the monitor or using the imagery to do sketchmapping in the office. There are, however, more sophisticated tools for using video imagery. MAG has been using the Map and Image Processing System (MIPS) software on a 80386 microcomputer with a math coprocessor. The software supports an array of peripheral devices including digitizers, plotters, color printers, scanners and optical disc drives.

MIPS offers the advantage of being able to capture video frames from tapes and convert them to a digital form. In MAG's case, the frames are captured as TARGA files, but

other formats are supported. Once the frames are stored as digital images, they can be geometrically corrected to a map base and mosaiced into flight line strips. The software permits the user to annotate polygons of pest activity or of information using a cursor on the screen.

Insects and Diseases Shape our Forest Environment

Judith E. Pasek
USDAFS, Forest Health Management, Rapid City, SD

An educational display was developed to illustrate examples of the roles and functions that insects and diseases play in changing forest environments. Photos and text introduce concepts of disturbance events and their relationship to stand conditions and fire dynamics, effects on tree growth and form, microclimate changes, nutrient recycling, creation of patchiness, creation of bird habitat, pollination, forest regeneration, and predation. Simple wording was chosen to make the display suitable for a general public audience. The display was developed in response to repeated requests from Forest Service districts for materials pertaining to insects and disease that could be used at fair booths and other public and educational events. The display will also be used during presentations to school and scout groups, which are in high demand in the Rapid City School System. The display was designed to fit on table top display panels that can be easily transported and set up in a matter of minutes.

Entomology on the World Wide Web

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Abstract: This poster display describes common World Wide Web and Internet terminology, gives examples of several entomology-related resources available on the World Wide Web, and is presented in conjunction with a live World Wide Web demonstration on a personal computer connected to the Internet through a modem and phone line.

World Wide Web Terminology

Internet

The Internet is the "network of networks" that connects nearly five million computer systems representing government agencies, research and educational organizations, commercial enterprises, and other groups in 90 different countries. Since the advent of the World Wide Web, connections to the Internet have increased at a phenomenal rate, particularly in the commercial sector, as businesses determine that there is a tremendous potential to reach new customers.

World Wide Web
In 1989, the World Wide Web Initiative was started at CERN, the European Laboratory for Particle Physics, in order to facilitate information exchange among scientists and researchers. The World Wide Web -- also known as WWW, W3,or simply The Web -- makes all the information resources on the Internet available in a single, continuous hypermedia information system.

Hypermedia
Hypertext provides a way to navigate through a document using links. Highlighted words in the text are used to navigate to other parts of the document. The Help system in MS-Windows is a typical example of hypertext.

Hypermedia is an extension of hypertext, which includes graphics, sounds, video, and two-way communications. On the Web, links may point to any information resource on any computer connected to the Internet anywhere in the world.

Mosaic
Mosaic was the first program to allow full use of the World Wide Web. Programs such as Mosaic allow one to navigate among Web resources (often referred to as "surfing the net") simply by pointing and clicking with a mouse. They are often referred to as a World Wide Web "browsers" or "clients".

Other examples of Web browsers include Netscape, Spyglass, and MacWeb. Web browsers are available for PCs, Macintoshes, Unix, and many other systems. The examples shown to the left were displayed using Netscape.

URL
On the World Wide Web, a link is a complete address to an information resource somewhere on the internet. The technical name for a WWW link is a Uniform Resource Locator, or URL. Examples of URLs may be seen in the "Location" box in the pictures of World Wide Web pages to the right.

Electronic Publishing
The Web offers tremendous potential for electronic publishing. Color graphics are cheap and easy to include. People can browse through documents and brochures via computer. If desired, they can print the documents in their homes. The USDA Extension Service in Washington, D.C. has been publishing documents electronically for a few years now, and have realized a 50% savings in publishing costs for those documents.

HTML
HTML stands for HyperText Markup Language. It is the common language of the WWW. They are simple text documents that include instructions which tell the Web browser how to display the document (e.g., This is a title. This part should be bold. Place a picture here. This text represents a link which points to this address.) HTML is a good means for presenting information on a computer screen, but leaves a lot to be desired in terms of graphical document design -- particularly if the user wishes to print the document.

PDF
PDF stands for Portable Document Format, and is one of several such formats. These differ from HTML in that they allow the presentation of documents exactly as they were designed, and can be printed by the users. PDF document viewing capabilities are currently being added to many of the Web browsers. Several organizations are beginning to offer PDF documents on the Web -- for example, the IRS offers nearly all of its forms in this format, and taxpayers may print exact copies in their homes.

Home Page
Each document on the Web is referred to as a "page". A Home Page is typically a main page -- a place where one might start looking for information about a particular subject. The Home Page for the USDA Forest Service, for example, is shown at right. A person searching for information about a particular Forest Service Ranger District might start at the Forest Service Home Page. Many individuals also maintain their own Home Pages.

Entomology on the World Wide Web
(Web page reproductions)

World Wide Web Virtual Library of Entomology
Colorado State University
http://www.colostate.edu/Depts/Entomology/ent.html

Entomology on the World Wide Web
Upcoming Events in Entomology
Upcoming Meetings of Entomological Interest
Colorado State University
http://www.colostate.edu/Depts/Entomology/meetings/meetings.html

46th Western Forest Insect Work Conference (WFIWC)
National Integrated Pest Management Information System
Colorado State University Component
http://www.colostate.edu/Depts/IPM/IPM.html

Information about the National IPM Network
http://ipm_www.ncsu.edu/ipmproject/ipminfo.html

Forestry/Entomology

http://www.colostate.edu/Depts/IPM/forest/forestry.html

Douglas-fir tussock moth information
http://www.colostate.edu/Depts/IPM/ento/j542.html

Gypsy Moth in North America
USDA Forest Service
http://www.fsl.wvnet.edu/gmoth/

Florida Entomologist Online
The first refereed, natural science journal on the Internet.
http://www.fcla.ufl.edu/FlaEnt/fehmpg.htm

USDA Forest Service
http://www.fs.fed.us/

Finnish Forest Research Institute (METLA)
http://www.metla.fi/

HUSSI: The Hopkins U.S. System Index, A Data Base of Forest Insects, their Hosts, Parasitoids, and Predators

Authors: Torolf R. Torgersen and Melvin E. McKnight.

Abstract: The Hopkins U.S. System consists of written records of insects and their damage, plant and insect hosts, and parasitic and predator/prey relationships. Each of these records is linked to a unique number the Hopkins Number. The Hopkins numbering system initiated in 1903, and was widely used within the U.S. Forest Service into the 1980's. The System now contains about 153,000 Hopkins cards and nearly 10,000 notebook pages. These cards were microfilmed in 1985. To make the information on the Hopkins cards and microfiche more accessible, Forest Insect and Disease Research, Wash., D.C., supported a project to compile a computerized data base of the Hopkins System. That data base, the Hopkins U.S. System Index (HUSSI) now contains about 61,000 records describing the contents of the Hopkins files and insect collections held by Forest Service units. Records held by the ARS Systematic Entomology Laboratory, Wash., D.C. have not been entered in HUSSI.

The information in HUSSI provides an accessible data base that can be queried in various ways. The dBase compatible data can be imported into programs such as ACCESS, FoxBase, RBase, PARADOX, and other "X"Base type programs within which specific queries and reports may be generated. The primary data fields are collection location, collector, date, taxon, insect and plant host association, repository of the insect or damage specimen and the Hopkins card, and whether there is additional biological information on the original Hopkins cards or notebooks.

Herbivorous Insects and Global Change: Potential Changes in the Spatial Distribution of Forest Defoliator Outbreaks

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The geographical ranges and the spatial extent of outbreaks of herbivorous species are likely to shift with climatic change. We investigate potential changes in spatial distribution of outbreaks of the western spruce budworm, *Choristoneura occidentalis* Freeman, in Oregon and the gypsy moth, *Lymantria dispar* (L.), in Pennsylvania using maps of historical defoliation, climate, and forest composition in a geographic information system. Maps of defoliation frequency were assembled using historical aerial reconnaissance data. Maps of monthly means of daily temperature maxima and minima and of monthly precipitation averaged over 30 years were developed using an interpolation technique. All maps were at a spatial resolution of 2 ´ 2 km. Relationships between defoliation status and the environmental variables were modeled using a linear discriminant function. Five climatic change scenarios were investigated: an increase of 2° C, a 2° increase with an increase of 0.5 mm per day in precipitation, a 2° increase with an equivalent decrease in precipitation, and equilibrium projections of temperature and precipitation by two general circulation models (GCMs) at doubled CO2.

With an increase in temperature alone, the projected defoliated area decreased relative to ambient conditions for the budworm and increased slightly for the gypsy moth. With an increase in temperature and precipitation, the defoliated area increased for both species. Conversely, the defoliated area decreased for both when temperature increased and precipitation decreased. Results for the GCM scenarios contrasted sharply. For the Geophysical Fluids Dynamics Laboratory model, defoliation by budworm was projected to cover Oregon completely, whereas no defoliation was projected by gypsy moth in Pennsylvania. For the Goddard Institute for Space Studies model, defoliation disappeared completely for the budworm and slightly exceeded that under ambient conditions for the gypsy moth. The results are discussed in terms of potential changes in forest species composition.

Management of Mountain Pine Beetle

Don Tinsley

Management of Ponderosa pine infected with Mountain pine beetle on the Dixie National Forest is dependent on issues identified through public scoping and the Interdisciplinary Team process. The Dixie National Forest has implemented an extensive public involvement program to help individuals and user groups understand the complexities of forest management and Mountain pine beetle management.

Dwarf Mistletoes: Biology, Pathology, and Systematics

Frank G. Hawksworth and Delbert Wiens
US Department of Agriculture, Forest Service
Agriculture Handbook 709 (1995) 410 pages

[Brian W. Geils, technical editor, Rebecca Nisley, managing editor]

Arceuthobium (dwarf mistletoes), a well-defined but morphologically reduced genus of the family Viscaceae, is parasitic on Pinaceae in the Old and New Worlds and on Cupressaceae in the Old World. Although conifer forest in many parts of the Northern Hemisphere are infested with dwarf mistletoes, those most commonly infested are in western North America and Mexico. In North America, *Arceuthobium* ranges from central Canada and southeastern Alaska to Honduras. Only *A. pusillum* occurs in eastern North America; and only *A. juniperi procerae* is found in the Southern Hemisphere. *Arceuthobium bicarinatum* and *A. azoricum* are restricted to islands (Hispaniola and the Azores, respectively).

In this taxonomic revision, the 46 recognized taxa comprise 42 species 4 with 2 subspecies each, and 1 with 2 formae speciales. Eight species are known in the Old World and thirty four species are in the New. Natural hybridization and polyploidy are unknown and have resulted in relatively clear, dendritic line of evolution. The genus is probably of early Tertiary origin and its closest relative is Notothixos, which has tropical Asian and Australasian distribution. *Arceuthobium* presumably migrated to the New World in before the Miocene Epoch. Intensive adaptive radiation occurred into the Pinaceae some of the species of *Abies*, *Picea*, *Tsuga*, *Larix*, *Pseudotsuga*, and 95% of species of the Pinus are parasitized.

The morphological characteristics that delimit species of *Arceuthobium* are often cryptic and may be apparent for only short periods of the life cycle. Species and subspecies, nonetheless, differ in a number of discontinuous variables. Most species are sympatric with other members of the genus somewhere in their distribution and flowering periods often overlap; but species appear to be isolated reproductively.

In additional to systematic and descriptive information for each species, we review ecological relationships, biotic associates, physiology, anatomy, pathogenic

effects, and methods of control for the *Arceuthobium.* Color pictures, distribution maps, and list of specimens examined are provided.

Field Trip

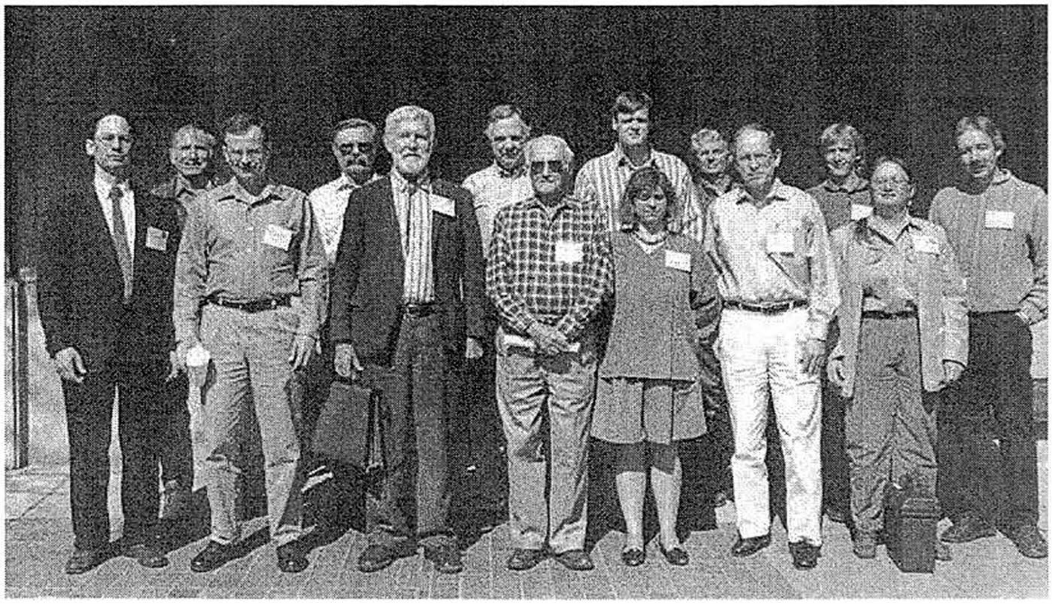
John M. Schmid

The field trip visited an area northwest of Custer, South Dakota in which epidemic mountain pine beetle (MPB) populations were causing extensive mortality in ponderosa pine (PP) stands. The members walked through 4 permanent plots that were part of a Black Hills study to determine the relationship between stand density and tree mortality caused by the MPB. Three of the plots were partially cut to growing stock levels (GSL) of 60, 80, and 116. The fourth plot was left uncut to serve as the control. Leave trees were selected on the basis of DBH, spacing, tree form, and apparent health. Mortality after partially cutting continued in the control but ceased in the GSL 60 and GSL 80. A group of trees were infested in the GSL 116 because a forked-top tree had one fork broken off in a wind storm just prior to MPB emergence and this tree served as the primary focus tree for the infested group. Tree mortality in the 4 plots was discussed with regard to silvicultural management of PP stands.

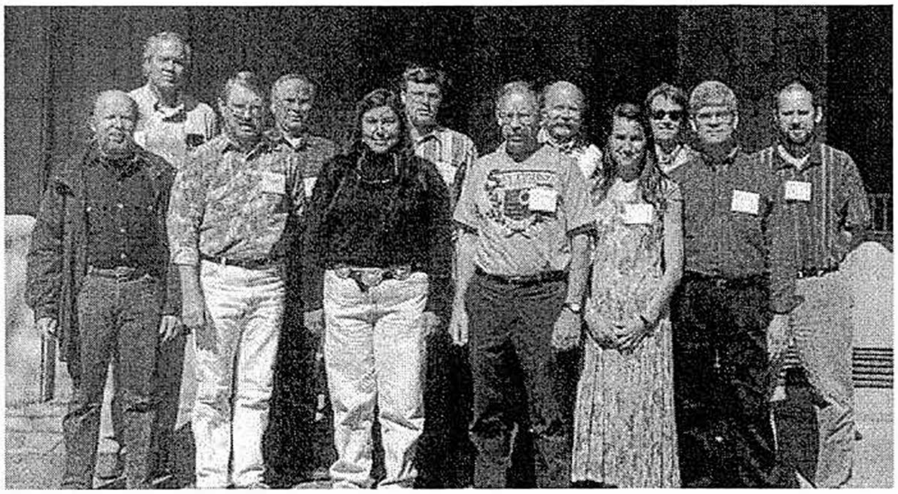
Following the tour of the plots, the members visited Mount Rushmore on the return trip to Rapid City.

Group Photos

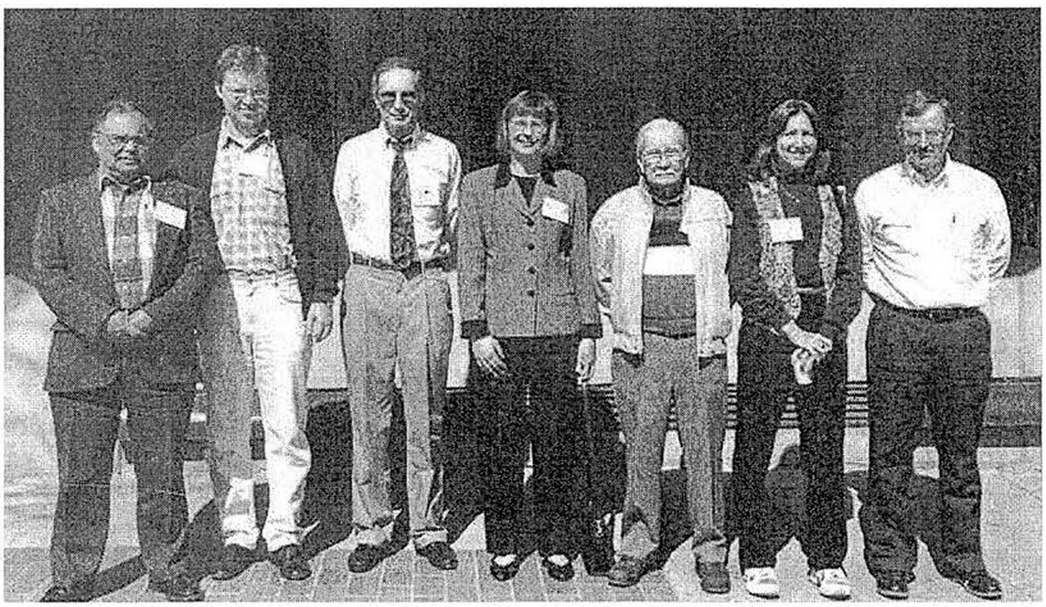
Front: Jesse Logan, Iral Ragenovich, Ken Raffa, Karen Ripley, Jorge Macias.
Back: Bob Stevens, Dave Nielsen, John Moser, Tom Gregg, Lynn Rasmussen, Terry Shore, Bob Backman



Front: Bill Schaupp, Lance R. David, Mal Furniss, Bill McCambridge, Judy Pasek, Bob Bridges, Ann Lynch
Back: Ken Lister, Bob Averill, Boyd Wickman, Brad White, Dave Johnson, Dave Roschke, Dave Maclean



Front: Tom Juntti, Roger Sandquist, Susan Johnson, Ron Billings, Paula Kleintjes, David Williams
Back: David Leatherman, Jed Dewey, Stuart Taylor, Tim McConnell, Don Tinsley, Kier Klepzig



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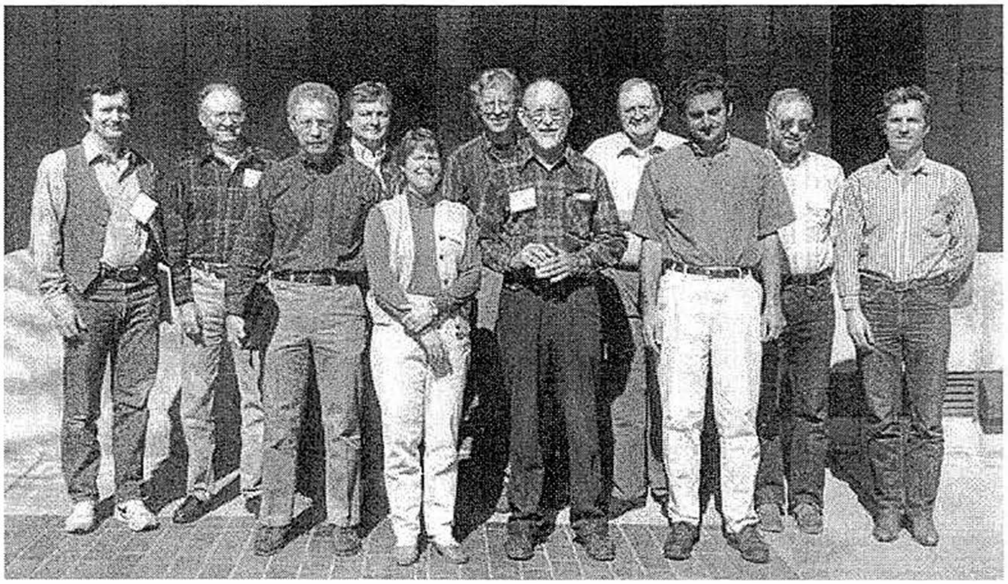
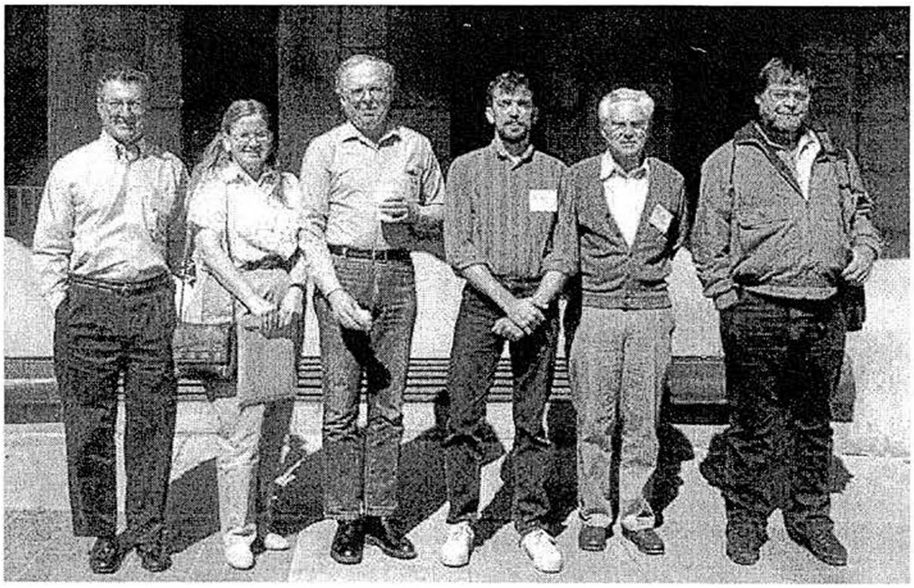


Back: Don Owen, LeRoy Kline, Noel Schneeberger, Sandy Liebhold, Mike Wagner, Dave Schultz, Steve Burke
Front: Ken Gibson, Jill Wilson, Pete Lorio, Keith Sprengel

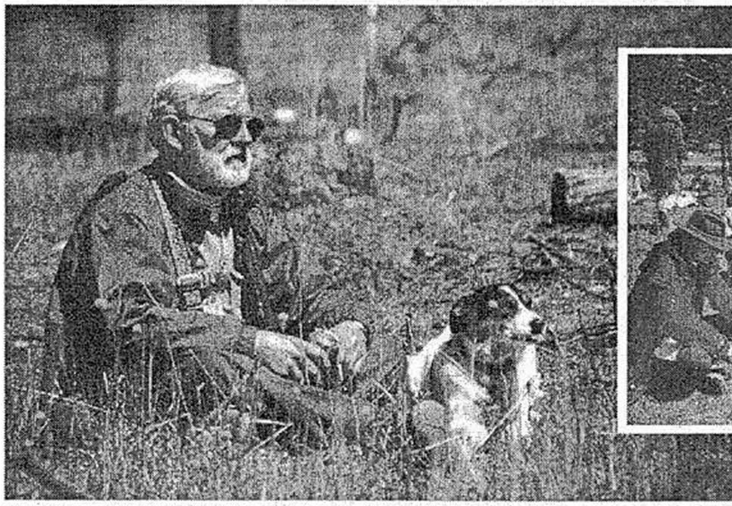
Back
Lorraine Maclaughlan, Barbara Bentz, Jim Vandygriff, Darrell Ross, Beth Willhite, Peter Hall
Front: Bob Celaya, Ron Stark, Don Dahlsten, Wayne Berisford, Lia Spiegel, Bruce Hostetler

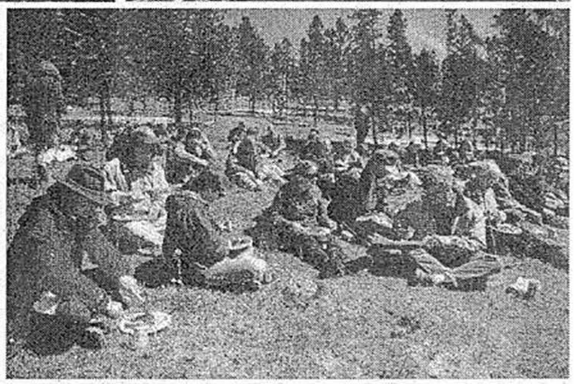
Front: Ladd Livingston, John Anhold, Phil Mocettini, Carol Randall, Ralph Their, Sandy Kegley
Back: Tom Eager, Eric Smith, David Beckman

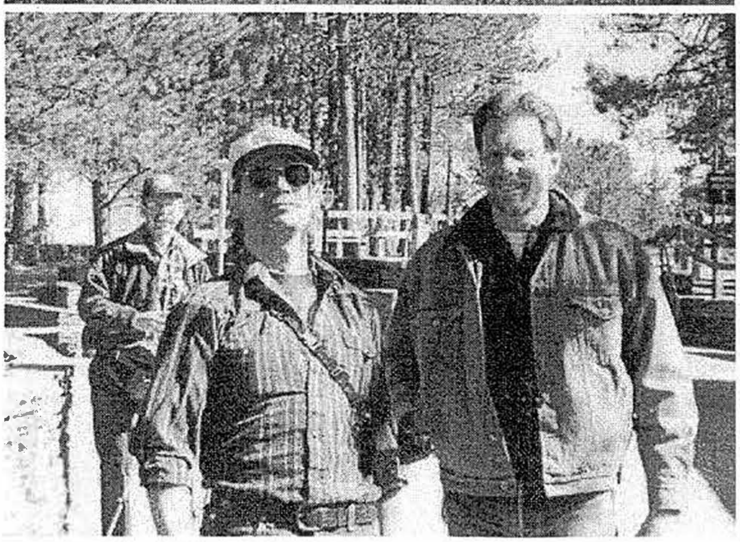


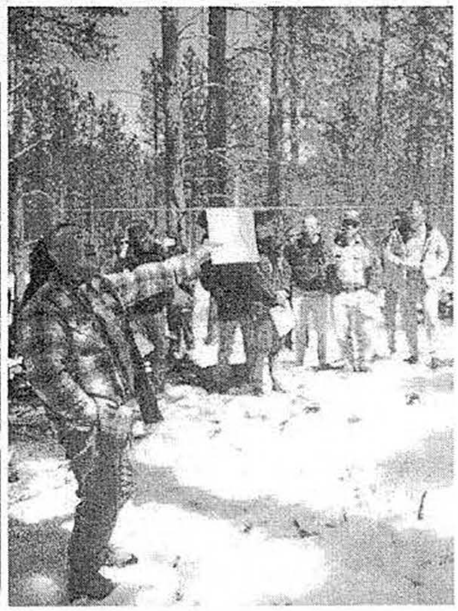
David A. Stein, Laura D. Merrill, John Dale, Roy Mask, Mel McKnight
Arden Tagestad

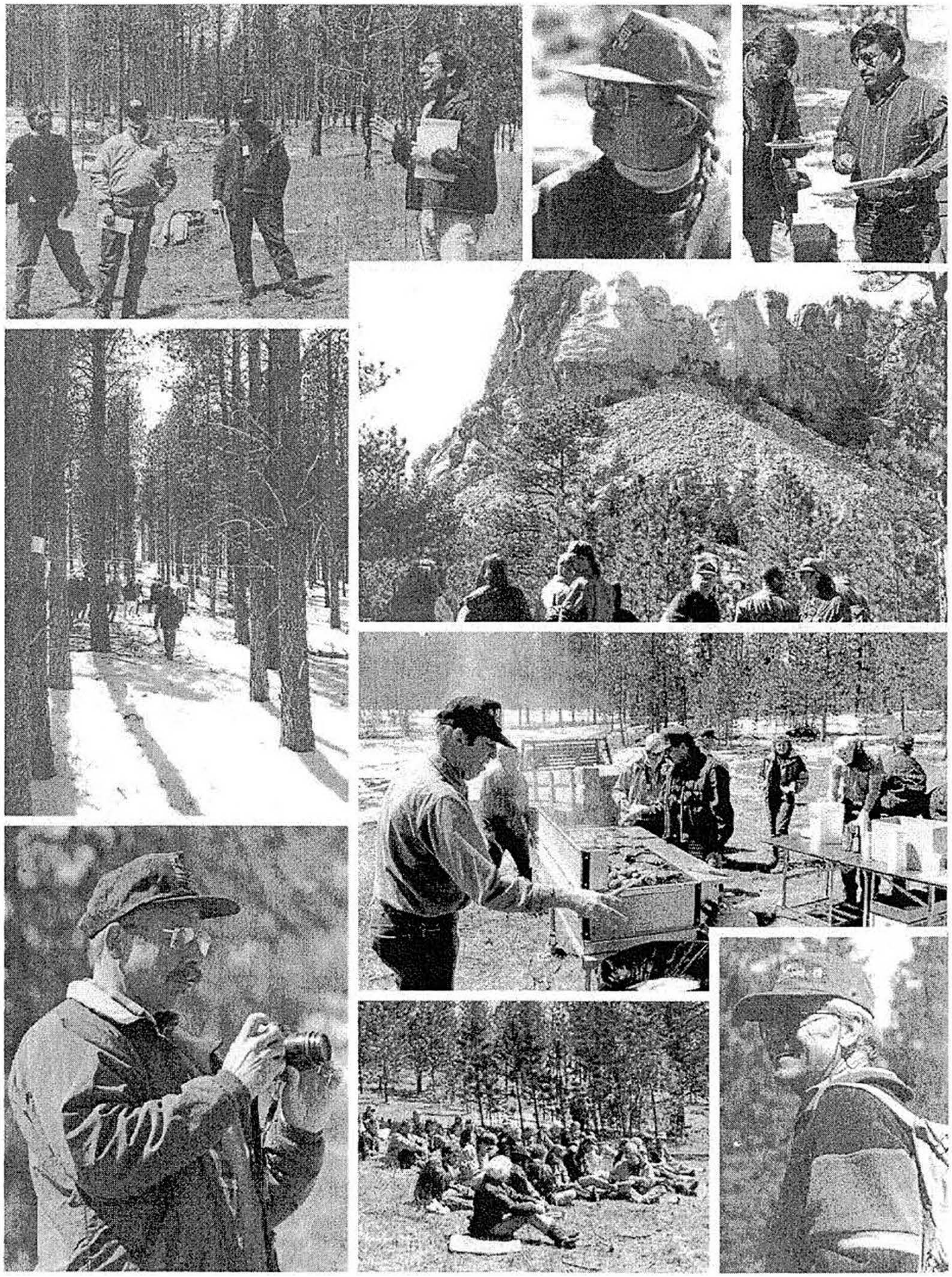
Conference Photos

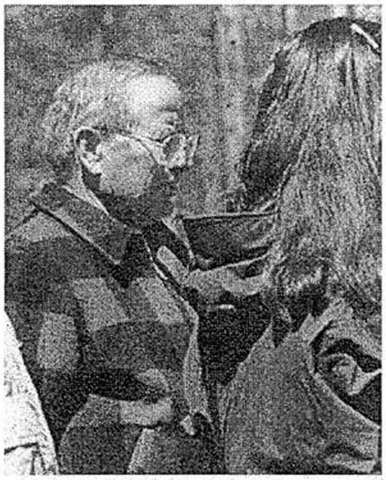


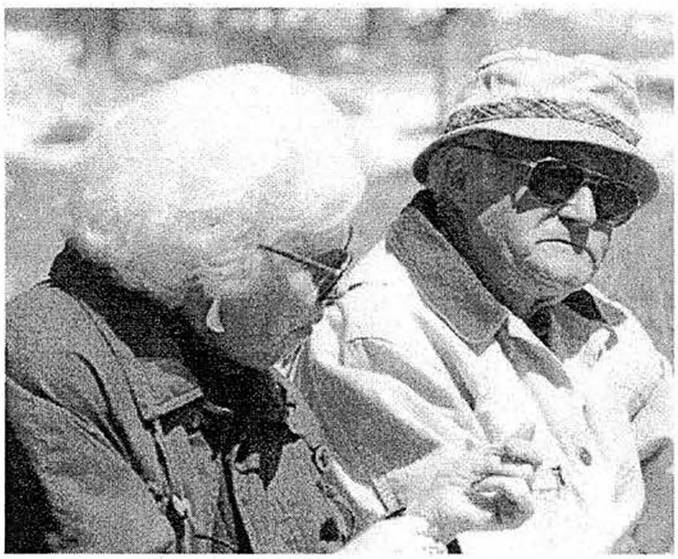
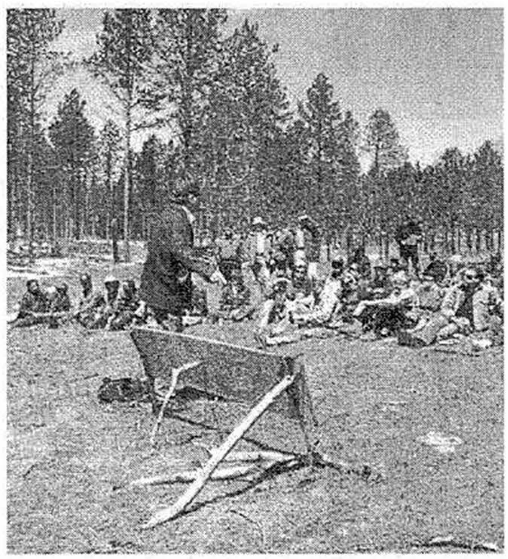




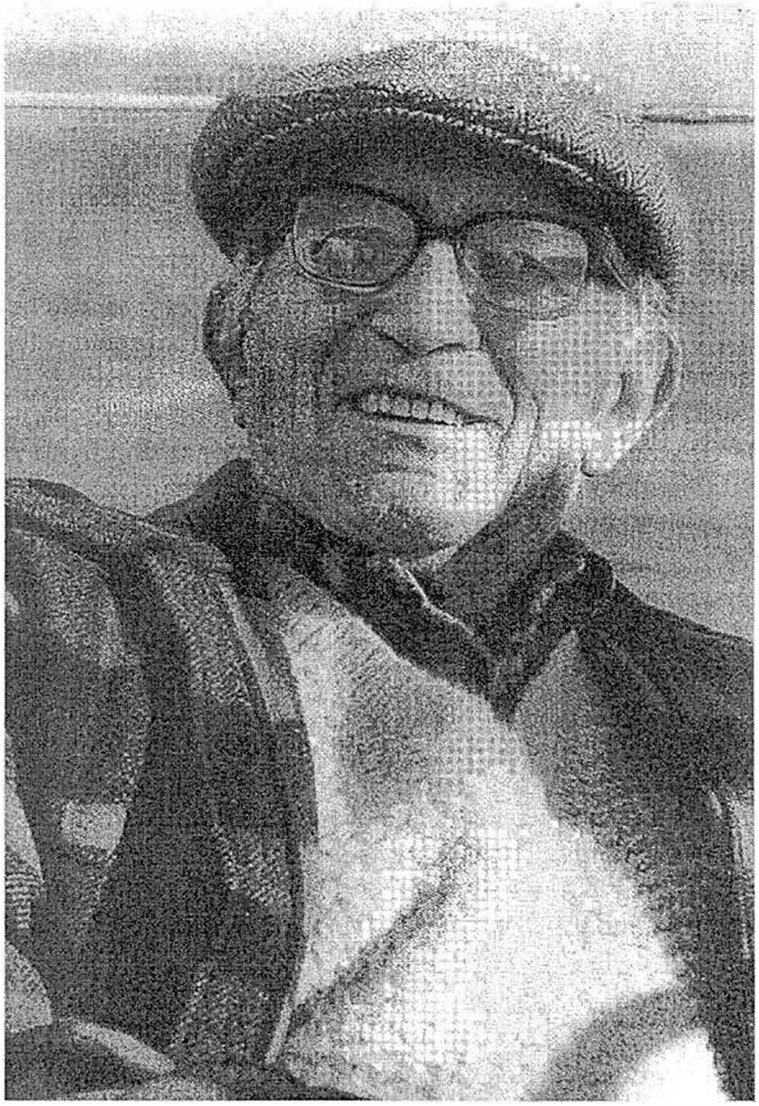






Obituary: Ralph Corbin Hall
1899-1996



Ralph Hall, a well-known forest entomologist, died January 19, 1996 at Corvallis, Oregon. He was born May 7, 1899, the second of seven children, on a farm near Ellenville, New York, where he gained a lasting love for the outdoors.

He enlisted in the Navy in 1918 and served on the cruiser USS Huntington, convoying troopships to Europe. In 1921, he enrolled at Syracuse University where he earned a block "S" in wrestling and majored in Silviculture. After graduation in 1925, he received a Bliss Scholarship from Harvard University where he received his M.S. in Silviculture in 1927.

His interest in entomology developed during his employment at Harvard Forest by Harvey J. MacAloney, who was studying the white pine weevil, *Pissodes strobi* (Peck), with the Bureau of Entomology, USDA. Thereafter, Ralph became Samuel A. Graham's first Ph.D. candidate at University of Michigan. During the academic year,

1929-1930, he exchanged positions with Leslie W. Orr, who was teaching forest entomology at University of Minnesota. This allowed Ralph to study statistics under J. Arthur Harris, a noted biometrician. His thesis provided the basis for silvicultural control of the bronze birch borer, *Agrilus anxius* Gory, and was a classic of that time.

While at Ann Arbor, he met and married Dorothy Dane Colby. After graduation, he was in charge of the Forest Insect Laboratory, USDA, at Columbus, Ohio from 1932-1938, where he studied the locust borer, *Megacyllene robiniae* (Forster).

In 1938, he transferred to the Berkeley Forest Insect Lab on the campus of the University of California. His field work, involving research, surveys and control supervision, was centered at the newly constructed Hat Creek Field Lab in Shasta Co. Virtually all of these activities involved cooperation with many private forestry companies, and state and federal agencies. Ralph excelled in this role. He was informal in his attire and manner, and easily befriended and gained the confidence of not only the foresters of these agencies, but also their administrators. All of them referred to him endearingly as "Doc" Hall.

At Hat Creek, he established a network of 20-ac plots on which he monitored weather, soil moisture and other factors which he related statistically to tree mortality caused by pine bark beetles (Hall 1958) and fir engraver beetles (Ferrell and Hall 1975). To aid this work, he invented a vernier tree-growth band (Hall 1942).

In 1945 he organized a cooperative effort to control an outbreak of pine engraver beetles and western pine beetles in ponderosa pine. This effort, called the Burney-McCloud Control Project provided for the State of California to share costs of control on private land. This precedent is credited in large part for subsequent enactment of the federal Forest Pest Control Act of 1947. That act provided for federal cost-sharing, and also resulted in increased staffing of forest entomologists by the Division of Forest Insect Investigations, USDA.

Hat Creek was the summer residence of the Hall family for many years, first at the old Hufford homestead, then in tents at the Field lab, and later on their own property along Hat Creek itself. There, they entertained many friends and visitors. Summer employees at the Lab included BEW (1948-1949) and William D. Bedard, Jr., both of whom were thereby influenced to pursue forest entomology as a career.

In 1953, the personnel of the Berkeley Forest Insect Lab were transferred, in place, to the Forest Service, USDA; in 1954, Ralph was placed in charge of forest insect surveys and control, Region 5, San Francisco. He retired from there in 1964 and became a private forest consultant, associated with Natural Resources Management Corp. One of his jobs involved applying NASA, ERTS-1 satellite imagery to detect and monitor forest insect outbreaks in Yosemite National Park. He also was employed during 1973 as an expert witness by the Klamath Indian Reservation in successful litigation involving a case related to an outbreak of bark beetles in the early 1900's. This assignment caused him to review old documents, and, we believe, let to his interest in preserving segments of forest entomology history. This interest developed into an oral history project in cooperation with the Forest History Society during 1974-1977, in which recollections of pioneer forest entomologists such as F. Paul Keen were recorded. He also obtained and made available many other documents for our own history projects, including correspondence of A. D. Hopkins, first Chief of Forest Insect Investigations.

"Doc" Hall enjoyed hunting and fishing and the camaraderie of others, including ourselves, who shared those interests. His 1979 Christmas card mentioned a successful antelope hunt in Wyoming (age 80). His knee joints were replaced in 1982 and 1983, but that did not deter his travels, which included Scotland, Alaska, New Zealand, Siberia and many other outing during which he fished for salmon and trout or was involved with forestry matters. In 1985 (age 86), he was "tapering off a bit from consulting," but, at age 90, he wrote a sustained-yield plan for a substantial private property in northeastern California.

He was a charter member (1949) of Western Forest Insect Work Conference, which honored him at a banquet at Sacramento in 1993. He served as Director of the Lassen Volcanic National Park Foundation, Chairmen of the California Forest Pest Action Council, and was a member of the Society of American Foresters (Fellow), American Association for the Advancement of Science (Fellow), Entomological Society of America, Association of Consulting Foresters of America, and New York Academy of Science. He was active in civic affairs in Orinda, Calif., being Man of the Year (1950) and received the Exceptional Service award (1952) and Silver Bearer Award (1955) for his work with the Boy Scouts of America. Other awards were presented to him by the Western Forestry and Conservation Assn., and the Council for Agricultural Science and Technology.

Ralph Hall was preceded in death by his wife Dorothy, and a daughter, Joanne Parrish. He is survived by two sons, James of Corvallis, OR, John of Columbia, MD, and a daughter, Judy Thompson of Berkeley. The family is planning a memorial service at Hat Creek in July.

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Boyd E. Wickman
George T. Ferrell

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List of Attendees

The following list was gathered from meeting registration records and is presented for informational purposes only. Not all records were complete. Readers should be aware that various addresses and affiliations might no longer be accurate at the time of publication of these proceedings.

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